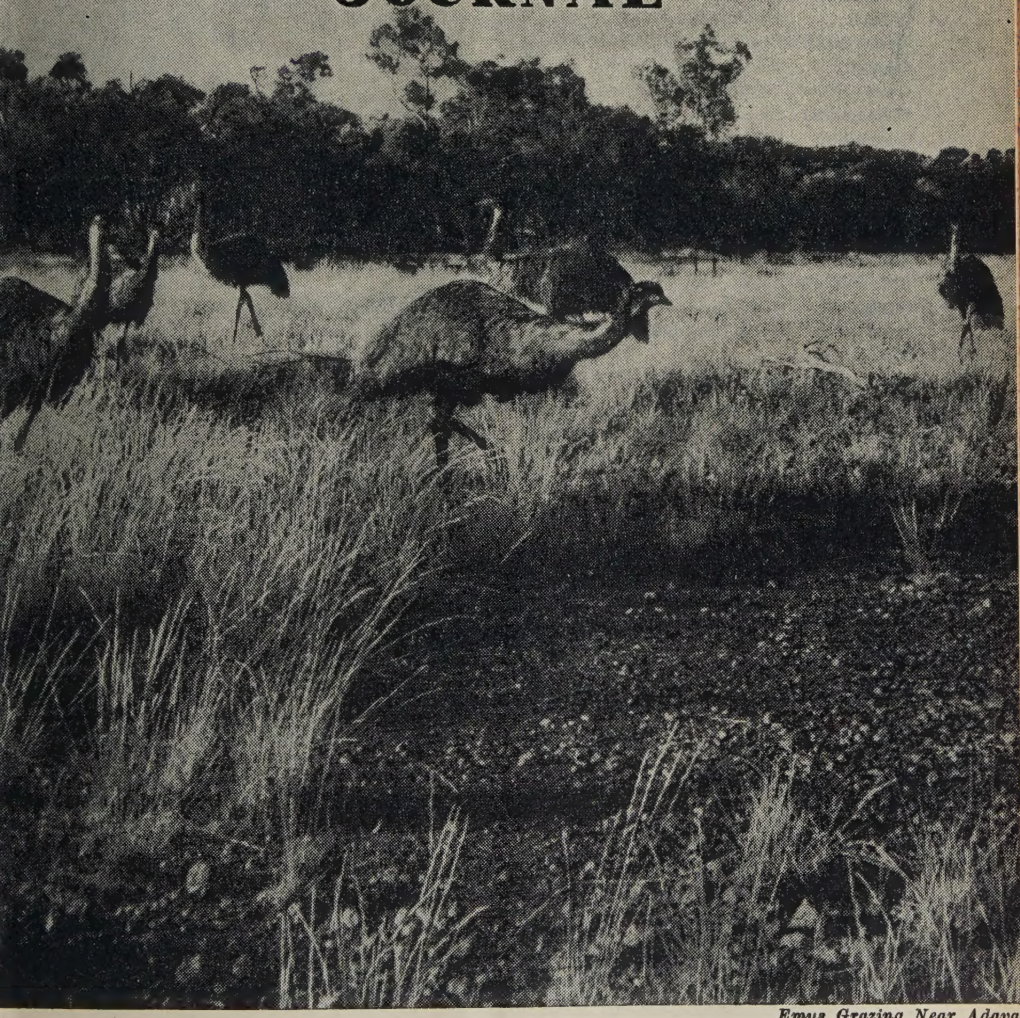
VOL. 80. PART 6 JUNE, 1955

OMMONWEALTH INST.
ITOMOLOGY LIBRARY
- 3 OCT 1955
RIAL Aus. 12
PARATE

DEPARTMENT OF AGRICULTURE

QUEENSLAND AGRICULTURAL JOURNAL



Emus Grazing Near Adava in the Central-West.

LEADING FEATURES

Land Leveller
Fauna Conservation
Vibriosis of Cattle
Beef Cattle in Central Queensland
Bean Quality
Sheep Feeding
Hatching Chickens
Dairy Calf Rearing

Registered at the General Post Office, Brisbane, for transmission by Post as a Newspaper.

EXTENSION SERVICES IN SOUTH QUEENSLAND.

★

Allora: Dairying.
Beaudesert: Agriculture, Dairying, Pig Raising, Stock Inspection.
Beenleigh: Dairying, Horticulture.
Biggenden: Dairying.
Boonah: Agriculture, Dairying, Stock Inspection.
Boondooma: Stock Inspection.
Brisbane: All Services.
Bundaberg: Agriculture, Dairying, Horticulture, Poultry Raising, Stock Inspection.
Caboolture: Dairying, Horticulture, Poultry.
Cadarga: Stock Inspection.
Charleville: Sheep and Wool, Stock Inspection, Veterinary Services.
Chinchilla: Dairying, Stock Inspection.
Clifton: Agriculture.
Coolangatta: Stock, Inspection.
Cooroy: Dairying, Horticulture.
Crow's Nest: Dairying, Stock Inspection.
Cunnamulla: Sheep and Wool, Stock Inspection, Veterinary Services.
Currumbin: Horticulture.
Dalby: Agriculture, Dairying, Sheep and Wool Stock Inspection.
Esk: Agriculture, Dairying.
Gatton: Agriculture, Dairying.
Gayndah: Agriculture, Cattle Husbandry, Horticulture, Stock Inspection.
Goombungee: Dairying.
Goondiwindi: Agriculture, Stock Inspection.
Gympie: Agriculture, Cattle Husbandry, Dairying, Horticulture, Stock Inspection.
Helidon: Stock Inspection.
Inglewood: Agriculture.
Injune: Stock Inspection.
Ipswich: Dairying, Poultry Raising, Stock Inspection.
Jandowae: Dairying, Stock Inspection.
Killarney: Dairying, Stock Inspection.
Kingaroy: Agriculture, Dairying, Stock Inspection, Veterinary Services.
Laidley: Dairying.
Maryborough: Dairying, Horticulture, Stock Inspection, Veterinary Services.
Miles: Cattle Husbandry, Stock Inspection.
Millmerran: Stock Inspection.
Monto: Agriculture, Dairying, Stock Inspection.
Mundubbera: Dairying, Stock Inspection.
Murgon: Agriculture, Dairying, Pig Raising, Stock Inspection.
Nambour: Dairying, Horticulture, Plant Disease and Pest Control, Stock Inspection.
Nanango: Dairying, Stock Inspection.
Oakey: Dairying, Stock Inspection.
Ormiston: Horticulture.
Palmwoods: Horticulture.
Pittsworth: Agriculture, Cattle Husbandry, Dairying, Stock Inspection.
Proston: Dairying.
Quilpie: Stock Inspection.
Roma: Sheep and Wool, Stock Inspection, Veterinary Services.
Southport: Dairying, Horticulture, Stock Inspection.
Stanthorpe: Horticulture, Plant Pest Control.
St. George: Sheep and Wool, Stock Inspection.
Toogoolawah: Stock Inspection.
Toowoomba: Agriculture, Dairying, Horticulture, Pig Raising, Plant Disease and Pest Control, Poultry Raising, Stock Inspection, Veterinary Services.
Wallangarra: Horticulture.
Warwick: Agriculture, Stock Inspection.
Wandoan: Agriculture, Cattle Husbandry, Dairying, Pig Raising, Sheep and Wool, Stock Inspection.
Wondai: Stock Inspection.
Yarraman: Stock Inspection.

(Lists of extension services in Central and North Queensland will appear in the next issue.)

Queensland AGRICULTURAL JOURNAL

Contents

Page

Field Crops—
A Home-made Land Leveller or Smoother. By E. W. Baird 311

Identifying Pigeon Pea Seed. By F. B. Coleman 315

Brucellosis-tested Swine Herds 316

Fruit Culture—
The Gravenstein Apple. By W. C. Armstrong 317

Vegetable Production—
Pod Quality in French Beans. By L. G. Trim 319

Fauna Conservation—
Queensland Fauna Conservation Legislation. "The Fauna Conservation Act of 1952." By C. Roff 323

Sheep and Wool—
The Supplementary Feeding of Sheep in Queensland. Part 2. What Does the Sheep Do With the Feed it Eats? By G. R. Moule .. 327

Animal Health—
Vibriosis of Dairy Cattle. By B. Parkinson 331

Poultry—
Successful Hatching. By C. H. Smith and F. N. J. Milne 337

Dairy Industry—
Dairying in the Netherlands. By L. E. Nichols 342

Dairy Farm Refrigeration in the Roma District. By G. R. Sigley .. 349

Cattle Husbandry—
The Beef Cattle Industry of Central Coastal Queensland. By J. Arbuckle 351

The Dairy Calf: Its Feeding and Management. By A. Hutchings and G. I. Alexander 363

Tuberculosis-Free Cattle Herds.

TESTED HERDS (As at 25th May, 1955).

The Tuberculosis-free Herd Scheme (which is distinct from the tuberculosis eradication scheme operating in commercial dairy herds) was initiated by the Department of Agriculture and Stock for the purpose of assisting owners of cattle studs to maintain their herds free from tuberculosis and so create a reservoir of tuberculosis-free cattle from which intending purchasers can draw their requirements. The studs listed here have fulfilled the conditions to the date shown above.

Breed.	Owner's Name and Address.
Aberdeen Angus ..	The Scottish Australian Company Ltd., Texas Station, Texas
A.I.S.	M. E. & E. Scott, "Wattlebrae" A.I.S. Stud, Kingaroy
	F. B. Sullivan, "Fermanagh," Pittsworth
	D. Sullivan, "Bantry" Stud, Rossvale, *via* Pittsworth
	W. Henschell, "Yarranvale," Yarranlea
	Con. O'Sullivan, "Navillus" Stud, Greenmount
	H. V. Littleton, "Wongalea" Stud, Hillview, Crow's Nest
	J. Phillips and Sons, "Sunny View," Benair, *via* Kingaroy
	Sullivan Bros., "Valera" Stud, Pittsworth
	Reushle Bros., "Reubydale" Stud, Ravensbourne
	H. F. Marquardt, "Chelmer" Stud, Wondai
	A. C. and C. R. Marquardt, "Cedar Valley," Wondai
	A. H. Sokoll, "Sunny Crest" Stud, Wondai
	W. and A. G. Scott, "Welena" A.I.S. Stud, Blackbutt
	G. Sperling, "Kooravale" Stud, Kooralgin, *via* Cooyar
	C. J. Schloss, "Shady Glen," Rocky Creek, Yarraman
	W. H. Thompson, "Alfa Vale," Nanango
	S. R. Moore, Sunnyside, West Wooroolin
	H.M. State Farm, Numinbah
	D. G. Neale, "Groveley," Greenmount
	Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy
	A. W. Wieland, "Milhaven" A.I.S. Stud, Milford, *via* Boonah
	W. D. Davis, "Wamba" Stud, Chinchilla
	Queensland Agricultural High School and College, Lawes
	C. K. Roche, Freestone, Warwick
	Mrs K. Henry, Greenmount
	D. B. Green, Deloraine Stud, Durong, Proston
	E. Evans, Wootha, Maleny
	T. L. and L. M. J. Cox, "Seafield Farm," Wallumbilla
	J. Crookey, "Arolla A.I.S. Stud" Fairview, Allora
	M. F. Power, "Barfield," Kapaldo
Ayrshire	L. Holmes, "Benbecula," Yarranlea
	J. N. Scott, "Auchen Eden," Camp Mountain
	"St. Christopher's" and "Iona" Studs, Brookfield road, Brisbane
	E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny
	C. E. R. Dudgeon, "Marionville" Ayrshire Stud, Landsborough
	G. F. H. Zerner, "Pineville," Pie Creek, Box 5, P.O., Gympie
	T. F. Dunn, Alanbank, Gleneagle
Friesian	C. H. Naumann, "Yarrabine" Stud, Yarraman
Guernsey	C. D. Holmes, "Springview," Yarraman
	A. B. Fletcher, Cossart Vale, Boonah
	W. H. Doss, Degilbo, *via* Biggenden
	A. C. Swendson, Coolabunia, Box 26, Kingaroy
	C. Scott, "Coralgrae," Din Din road, Nanango
	R. J. Wissemann, "Robnea," Headington Hill, Clifton
Jersey	Queensland Agricultural High School and College, Lawes
	J. S. McCarthy, "Glen Erin" Jersey Stud, Greenmount
	J. F. Lau, "Rosallen" Jersey Stud, Goombungee
	G. Harley, Hopewell, M.S. 189, Kingaroy
	Toowoomba Mental Hospital, Willowburn
	Farm Home for Boys, Westbrook
	F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line
	R. J. Browne, Hill 60, Yangan
	P. J. L. Bygrave, "The Craigan Farm," Aspley
	R. J. Crawford, "Inverlaw" Jersey Stud, Inverlaw, Kingaroy
	P. H. F. Gregory, "Carlton," Rosevale, *via* Rosewood
	E. A. Matthews, "Yarradale," Yarraman
	A. L. Semgreen, "Tecoma," Coolabunia
	L. E. Meier, "Ardath" Stud, Boonah
	A. M. and L. J. Noone, "Winbirra" Stud, Mt. Esk Pocket, Esk
	W. S. Conochie and Sons, "Brookland" Stud, Sherwood road, Sherwood
	Estate of J. A. Scott, "Kiaora," Manumbar road, Nanango
	F. W. Verrall, "Coleburn," Walloon
	C. Beckingham, Trouts road, Everton Park
	W. E. O. Meier and Son, "Kingsford" Stud, Alberton, *via* Yatala
	G. H. Ralph, "Ryecombe," Ravensbourne
	Mrs. I. L. M. Borchert, "Willowbank" Jersey Stud, Kingaroy
	W. and C. E. Tudor, "Boree" Jersey Stud, M.S. 498, Gayndah
	Weldon Bros., "Gleneden" Jersey Stud, Upper Yarraman
	D. R. Hutton, "Bellgarth," Cunningham, *via* Warwick
	J. W. Carpenter, Flagstone Creek, Helidon
	H. G. Johnson, "Windsor" Jersey Stud, Beaudesert
	W. S. Kirby, Tinana, Maryborough
	S. A. Cramb, "Trecarne Stud," Lockyer
	G. & V. Beattie, "Beauvern," Antigua, Maryborough
Polled Hereford ..	W. Maller, "Boreview," Pickanjinnie
	J. H. Anderson, "Inverary," Yandilla
	D. R. and M. E. Hutton, "Bellgarth," Cunningham, *via* Warwick
	E. W. G. McCamley, Eulogie Park, Dululu
	Wilson and McDouall, Calliope Station, Calliope

A Home-made Land Leveller or Smoother.

By E. W. BAIRD, Senior Adviser in Agriculture.

One of the requisites of furrow irrigation, if full efficiency is to be attained, is to prepare the land in such a manner before planting that water distribution during irrigation can be easily controlled.

Many instances can be found where irrigation water flows irregularly down the furrows with consequent unevenness in water penetration. Plant growth and consequently yields are thus affected adversely, either by inadequate penetration where the water flows too quickly, or by waterlogging where the flow rate is too slow and ponding occurs.

In order, therefore, to obtain the efficiency of watering which is necessary to produce the best conditions for plant growth, care must be taken during the final stages of land preparation. To this end, the use of the land leveller or smoother is recommended.

This is an implement consisting of two long wooden runners, joined by stout wooden cross-pieces and braced by round-iron stays. As this frame is drawn over the land, small ridges are scraped off and small hollows are filled up. By traversing the field in both directions all traces of dead

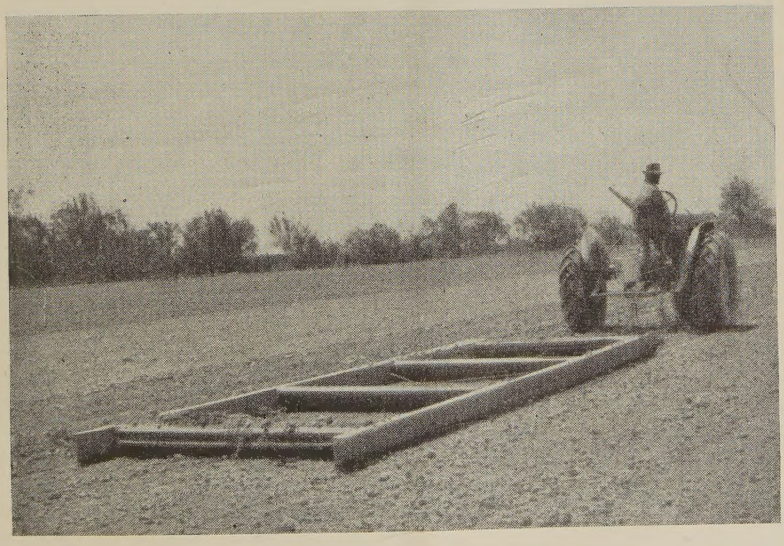


Plate 1.

The Home-made Land Leveller or Smoother at Work Preparing Tobacco Land for Furrow Irrigation: Tobacco Experiment Station, Inglewood.

furrows, disc harrow ridges, minor hollows, etc. can be eliminated. This makes for easy and efficient irrigation.

It is to be stressed that large hollows or hills cannot satisfactorily be corrected with the leveller, and graders should be used under these conditions. There it is a question of transporting reasonably large amounts of soil from one point to another and an implement with a movable blade which can pick up and drop soil is required. The leveller is designed to add the finishing touches to land which has previously been graded.

In all instances where furrow irrigation is proposed, it is essential that the direction of irrigation be given considerable attention. The slope of the land may be obtained by the use of various types of level, and the time spent on this operation will be amply repaid by the reduced costs of irrigation as well as by the results achieved from the following crop.

When the direction of watering has been defined, the land leveller should be used after the last harrowing. Two smoothings should be carried out, the first at right angles to the direction of watering and the second in the direction of watering.

For best results the soil should be dry and in seedbed condition during smoothing operations. Under lumpy or moist soil conditions satisfactory smoothing cannot be achieved, as the soil does not "flow" freely.

The efficiency of the leveller, as of an ordinary grader, is dependent on the length of the side runners. In general, the longer these are, the more efficient will be the leveller, but it is considered that 20 feet is a suitable compromise between manoeuvrability and efficiency.

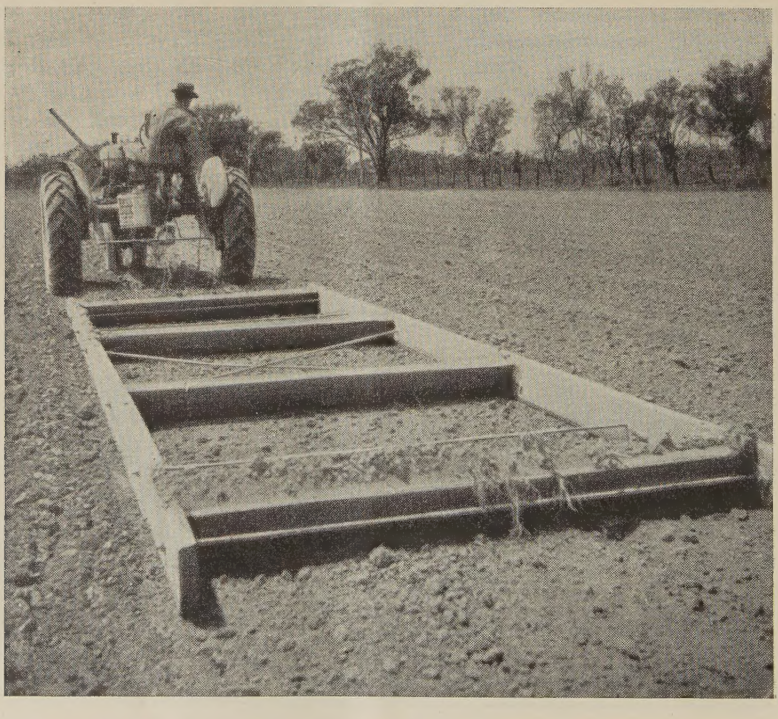


Plate 2.

Close-up Rear View of The Leveller. Most of the construction details are visible in this picture.

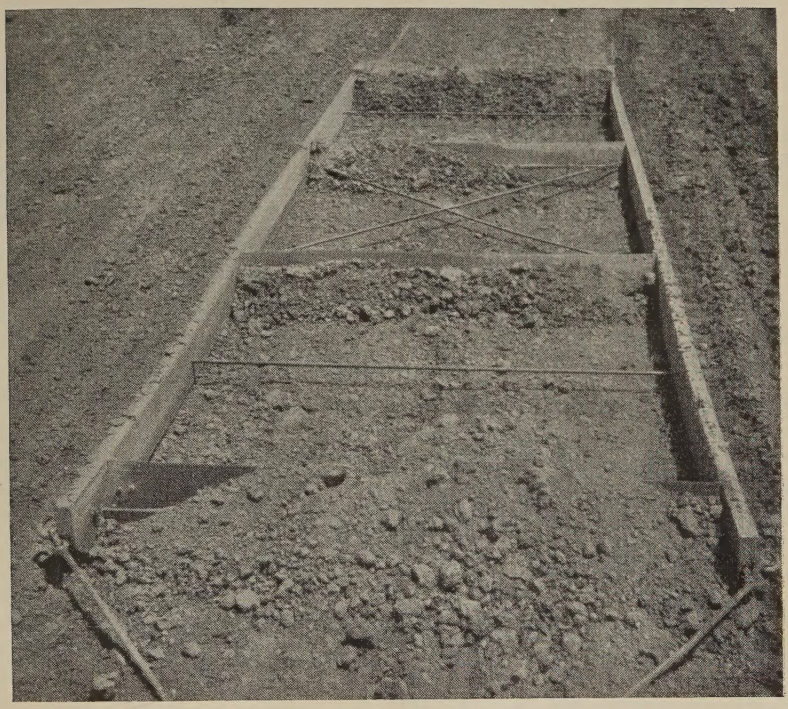


Plate 3.

Front View of the Leveller in Operation. The scraping action of the angled cross-pieces is shown in this view.

Construction.

The leveller to be described has side runners 20 feet in length, 4 cross-pieces (smoothing boards) each 6 feet in length, together with half-inch round-iron braces. The centre braces are crossed for added support. The cross-pieces are equally spaced along the length of the leveller. Iron hooks are attached to the outside of the runners and a $\frac{5}{8}$ inch round-iron or chain hitch is attached to them.

When the leveller is in use, it is advisable to attach a chain or wire rope at least 10 feet in length to the tractor hitch. If the leveller is hitched too close to the tractor the front of the implement tends to lift and efficiency is reduced. It will be noticed on the plan that the cross-pieces are set at an angle of approximately 45 degrees to the vertical, leaning towards the rear of the leveller. These cross-pieces are let in to the side runners half an inch on either side, and are fixed level with the bottom of the runners.

Each cross-piece is shod with angle-iron to provide a cutting edge and prevent excessive wear on the timber. Behind each at either end, right-angled straps of $1\frac{1}{4}$ by $\frac{1}{4}$ inch flat-iron are placed, which secure the cross-pieces, bolting them to the side runners. These straps are found necessary as, despite the tightened braces, the cross-pieces are inclined to lift out of the slots when loaded with soil or when turning corners.

It is advisable to round the leading edge of the runners, as on a slide, and tack on sheet-iron strips to protect the end grain.

Plate 4.

The Smoothing Effect of the Leveller in Preparing Land for Furrow Irrigation of Tobacco. The land on the left has been treated by the leveller, whereas that on the right is untreated.

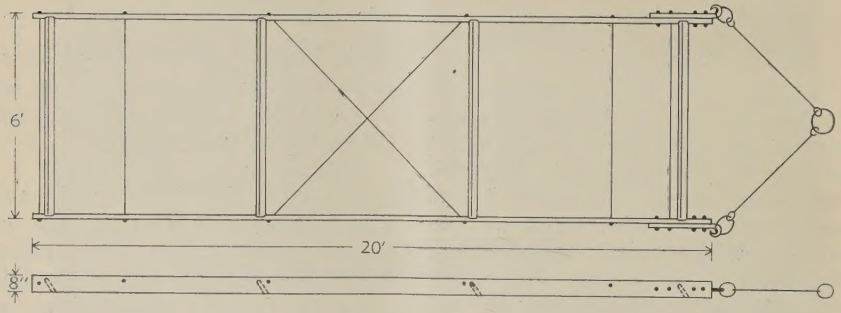


Plate 5.

Plan and Elevation of Leveller, Showing Dimensions and Details of Construction.

Specifications.

Specifications for the construction of the leveller are as follow:—

- 8″ x 2″ hardwood runners, 2 x 20 ft.; 4 x 6 ft.
- 2 draw hooks 1″ x $\frac{5}{8}$″; $\frac{5}{8}$″ draw hitch as per plan;
- 2 tie rods 8′6″ x $\frac{1}{2}$″;
- 4 tie rods 6′2″ x $\frac{1}{2}$″;
- 4 lengths 2″ x $\frac{1}{8}$″ x 5′8″ angle-iron drilled at 3 points to take $\frac{1}{2}$″ bolts;
- 8 right-angled plates 1$\frac{1}{4}$″ x $\frac{1}{4}$″, with 4″ sides bored with 4 holes of size $\frac{5}{16}$″;
- 2 dozen 3″ x $\frac{1}{2}$″ hex. bolts with nuts and washers;
- 32 bolts 2$\frac{1}{2}$″ x $\frac{5}{16}$″, with nuts and washers.

The leveller can be made easily by any handyman on the farm at a cost for materials of £13—£15.

Identifying Pigeon Pea Seed.

By F. B. COLEMAN, Standards Officer, Standards Branch.

Unfortunately, the name pigeon pea is applied to three different types of seed, all of which are grown in Queensland.

Pigeon pea is the correct designation of the seed used by cane growers and others for green manure purposes. It is known botanically as *Cajanus cajan* and is an erect woody shrub of perennial habit.

The flowers are yellow or orange, brownish on the outside with varying colour combinations. Pods are up to three inches long, half an inch broad and hairy. The seeds vary slightly in size and colour, the smaller being tan, and those slightly larger putty coloured with tan spots, particularly around the hilum. The hilum in both cases is white.

The mottled field pea is often miscalled pigeon pea; hence the confusion between the seeds. This field pea has a vine similar to the garden pea, but the wings of the flowers are purple. The pods are small, green and smooth. The peas when shelled are green, and when cooked turn dark brown, with a corresponding discolouration of the water.

Botanically, they are known as *Pisum sativum* var. *arvense*. They are sometimes grown for forage, and are most unsuitable for growing in sugar-cane areas.

The mottled seeds of this field pea are round, of brown or tan colour on a lighter background; some seeds have a slight greenish tinge. The hilum is small, inconspicuous and of dull self-colour.

The seeds are illustrated in Plate 1.

When ordering pigeon pea seed, buyers should clearly state the purpose for which they desire the seed. If doubtful of the identity of the seed bought they should forward a sample to the Standards Branch for identification. Sellers should be careful to ensure that the correct seed is forwarded.

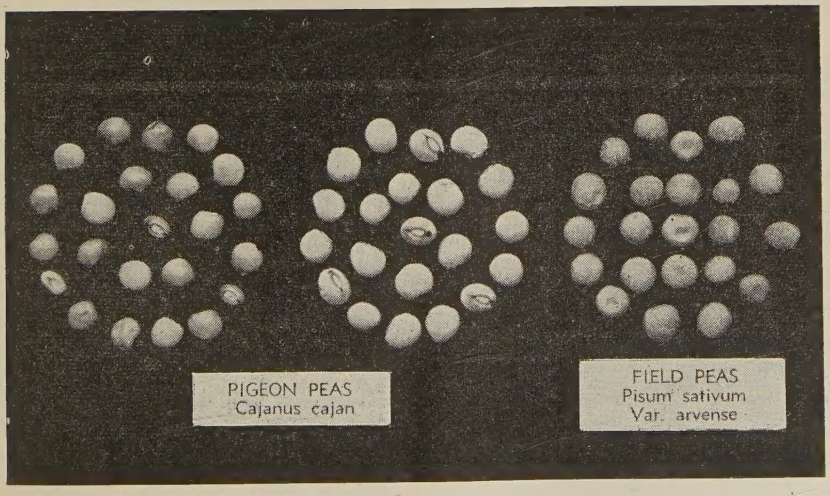


Plate 1.

Seeds sold as Pigeon Pea Seed.

Brucellosis-Tested Swine Herds.

TESTED HERDS (As at 31st May, 1955).

Berkshire.

A. P. and N. Beatty, "Deepdene," Barambah road, Nanango
S. Cochrane, "Stanroy" Stud, Felton
G. Handley, "Handleigh" Stud, Murphy's Creek
J. L. Handley, "Meadow Vale" Stud, Lockyer
O'Brien and Hickey, "Kildurham" Stud, Jandowae East
G. C. Traves, "Wynwood" Stud, Oakey
Westbrook Farm Home for Boys, Westbrook
M. K. Collins, "Kennington" Stud, Underwood road, Eight Mile Plains
H.M. State Farm, "Palen" Stud, Palen Creek
A. R. Ludwig and Sons, "Beau View" Stud, Beaudesert
H. H. Sellars, "Tabooba" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trouts road, Aspley
R. H. Crawley, "Rockthorpe" Stud, *via* Pittsworth
F. R. J. Cook, Middle Creek, Pomona
Mrs. I. M. James, "Kenmore" Stud, Cambooya
H. L. Stark, "Florida," Kalbar
J. H. N. Stoodley, "Stoodville," Ormiston
H.M. State Farm, Numinbah
V. G. M. and A. G. Brown, "Burdell," Goovigen
N. F. Cooper, Maidenwell
R. H. Coller, Tallegalla, *via* Rosewood
E. J. Clarke, "Kaloon" Stud, Templin
M. G. and R. H. Atkins, "Diamond Valley" Stud, Mooloolah
L. Puschmann, "Tayfeld" Stud, Taylor
Dr. B. J. Butcher and A. J. Parnwell, "Hartley Grange" Stud, 684 Logan Road, Greenslopes
C. E. Edwards, "Spring Valley" Stud, Kingaroy
G. McLennan, "Murcott" Stud, Willowvale
H. M. Wyatte, "Deepwater" Stud, Rocky Creek, Yarraman
C. F. W. and B. A. Shellback, "Redvilla" Stud, Kingaroy
R. J. Webber, "Webberberry" Stud, 35 Caxton st., Petrie Terrace
J. C. Lees, "Bridge View" Stud, Yandina
F. Thomas, "Rosevale" Stud. M.S. 373, Beaudesert
A. C. Fletcher, "Myola" Stud, Jimbour
Q.A.H.S. and College, Lawes
E. F. Smythe, "Grandmere" Stud, Manyung, Murgon
The Marsden Home for Boys, Kallangur
M. F. Callaghan, Lower Mount Walker, via Rosewood
J. B. Lotz, M.S. 794, Kalbar
G. J. Hutton, Woodford
E. R. Kimber, Coalstoun Lakes
K. B. Jones, "Cefn" Stud, Pilton
A. J. Potter, "Woodlands," Inglewood

Large White.

H. J. Franke and Sons, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
J. A. Heading, "Highfields," Murgon
K. B. Jones, "Cefn" Stud, Pilton
R. Postle, "Yarralla" Stud, Pittsworth
B. J. Jensen, "Bremerside" Stud, Rosevale, *via* Rosewood
E. J. Bell, "Dorne" Stud, Chinchilla
L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
H. R. Gibson, "Thistleton" Stud, Maleny
H.M. State Farm, Numinbah
K. A. Hancock, "Laurestonvale" Stud, Murgon
V. P. McGoldrick, "Fairymeadow" Stud, Cooroy
S. T. Fowler, "Kenstan" Stud, Pittsworth
M. D. Power. "Ballinasloe" Stud, Swan Creek, *via* Warwick
P. V. Campbell, "Lawn Hill" Stud, Lamington
H. L. Larsen, "Oakway," Kingaroy
N. E. Meyers, Halpine Plantation, Kallangur
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
G. I. Skyring, "Bellwood" Stud, *via* Pomona
O. J. Horton, "Manneum Brae" Stud, Manneum, Kingaroy
F. K. Wright, Narangba, N. C. Line
O. B. Vidler, Manneum, Kingaroy
K. F. Stumer, French's Creek, Boonah
Q.A.H.S. and College, Lawes
R. S. Powell, "Kybong" Stud, Kybong, *via* Gympie
S. and S. Ouglitchinin, "Pinefields," Old Gympie road, Kallangur
C. Wharton, "Central Burnett" Stud, Gayndah
S. Jensen, Rosevale, *via* Rosewood
Kruger and Sons, "Greyhurst," Goombungee
V. V. Radel, Coalstoun Lakes

Tamworth.

S. Kanowski, "Miecho" Stud, Pinelands
N. R. Potter, "Actonvale" Stud, Wellcamp
D. F. L. Skerman, "Waverley" Stud, Kaimkillenbun
A. C. Fletcher, "Myola" Stud, Jimbour
Salvation Army Home for Boys, "Canaan" Stud, Riverview
A. J. Surman, "Namrus" Stud, Noble road, Goodna
Department of Agriculture and Stock, Regional Experiment Station, Kairi
E. C. Phillips, "Sunny View," M.S. 90, Kingaroy
F. N. Hales, Kerry road, Beaudesert
T. A. Stephen, "Withcott," Helidon
W. F. Kajewski, "Glenroy" Stud, Glencoe
A. A. Herbst, "Hillbanside" Stud, Bahr Scrub, *via* Beenleigh
H.M. State Farm, Numinbah
D. B. Alexander, "Debreczen" Stud, Kinleymore, *via* Murgon
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
G. H. Sattler, Landsborough
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
H. J. Armstrong, "Alhambra," Crownthorpe, Murgon
Q.A.H.S. and College, Lawes
R. H. Coller, Tallegalla, *via* Rosewood
A. J. Potter, "Woodlands," Inglewood

Wessex Saddleback.

W. S. Douglas, "Greylight" Stud, Goombungee
J. Gleeson, "Iona Vale" Stud, Kuraby
C. R. Smith, "Belton Park" Stud, Nara
H. H. Sellars, "Tabooba" Stud, Beaudesert
H. Thomas, "Eurara" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trout road, Aspley
J. B. Dunlop, "Kurrawyn" Stud, Acacia road, Kuraby
F. K. Wright, Narangba, N. C. Line
R. A. Collings, "Rutholme" Stud, Waterford
W. R. Dean, "Trelawn," Tandur, *via* Gympie
M. Nielsen, "Cressbrook" Stud, Goomburra
G. J. Cooper, "Cedar Glen" Stud, Yarraman
Mrs. R. A. Melville, "Wattledale Stud," Beenleigh road, Sunnybank
A. J. Stewart, "Springbrook," Pie Creek road, Gympie
S. and S. Ouglitchinin, "Pinefields," Old Gympie road, Kallangur
R. J. Hicks, M.S. 98, Darlington, *via* Beaudesert
Kruger and Sons, "Greyhurst," Goombungee

British Large Black.

H. W. Naumann, "Parkdale" Stud, Kalbar

The Gravenstein Apple.

By W. C. ARMSTRONG, Adviser in Horticulture.

The Gravenstein apple apparently originated in the garden of Grafenstein castle in Germany and reached England from Holland early in the 19th century.

In England, the variety has always been of minor importance and most of the Gravenstein apples marketed in European countries come from Nova Scotia in Canada, where the variety is widely grown. In Queensland, it is popular because the fruit matures early in the season when few apples of comparable dessert and cooking quality are on the market.

Description.

The fruit is medium in size, round, flattened and rather angular in shape, with a yellowish skin carrying a reddish flush and a striped pattern. The flesh is crisp, very juicy, with a pronounced aroma which is in part responsible for its excellent dessert quality.

Though primarily a dessert apple, the fruit is also an excellent cooker in the green sub-mature stage and can be harvested as such early in the season. As the market for early cookers weakens, the fruit is left on the tree to colour up for the dessert trade in January.

In recent years, a number of bud sports of the Gravenstein apple have been introduced to Stanthorpe and two of them may become important in commercial practice. They are known as Banks Red Gravenstein and Gravenstein Rouge respectively.

Gnarling.

The young Gravenstein tree is vigorous and promises well during its early years. Orchard plantings are, however, seldom long-lived, mainly because of the incidence of "gnarling," a disorder which is characteristic of the variety.

The symptoms of the disorder are aptly described by its common name, for a twisting of the wood is typical and bark depressions run the length of the affected trunk and/or branches.

The external symptoms are caused by a partial breakdown in the cambial tissues under the bark, and as the activity of these tissues determines the increase in stem diameter, the general appearance of the limb is altered. Usually a single limb is affected in the first instance and the rest of the tree may remain productive for many years. Ultimately, however, trunk and limbs become very corrugated and the tree dies out completely after a period of indifferent bearing.

Some years ago "gnarling" was thought to be the result of stock-scion incompatibility, but this view is now out of favour, although some growers still contend that Gravenstein apples

propagated on their own roots are a better proposition than trees propagated on Northern Spy or seedling stocks.

However, evidence accumulated during recent years suggests that the disorder is due primarily to a virus infection and thus resembles the somewhat similar trouble in grapefruit which is known as stem pitting. In future, therefore, it will be necessary to propagate the Gravenstein with scion wood from mature trees which are free from the virus.

"Gnarling" makes the Gravenstein a somewhat speculative variety, and practices which tend to minimise the trouble are therefore popular. One of these is particularly suitable for the Stanthorpe district.

It consists in planting out a strong growing variety such as King David and strap-grafting all the leaders in the third year with Gravenstein scions from trees which are free from symptoms of the disorder. The older the trees from which scion wood is cut the better, provided, of course, they are healthy. A King David tree refurnished with Gravenstein scions at three years comes into bearing quickly, and should one or two leaders develop symptoms of "gnarling" later on, they can be removed and a good tree can still be made from the balance.

Pollination.

In some apple varieties, the flowers fail to set fruit when they are self-pollinated, while others set a medium crop. However, even varieties of the latter type are normally interplanted with a second variety to ensure cross-pollination, which improves the set and tends to eliminate erratic bearing.

Self sterility in a variety is determined by the constitution of the reproductive cells and in particular the number of chromosomes in the nucleus which carry the hereditary characteristics. The original wild apple from which the cultivated varieties have been derived apparently had a chromosome complement of 17. Most of the varieties in cultivation to-day have a chromosome complement of 34 and are known as diploids. In these diploid varieties, self pollination can take place and a block planting of a single variety will bear fruit although the crop may not be a particularly good one.

The Gravenstein tree has a chromosome complement of 51. It is therefore triploid in type and like all triploids is completely self-sterile. Actually the pollen is non-viable. Fruit setting can therefore occur in the Gravenstein only if it is interplanted with other varieties which are suitable for cross pollination.

A block of Gravenstein apples could be interplanted with a second variety such as Delicious. In commercial practice, this would not be very satisfactory, for as Gravenstein pollen is non-viable, the Delicious trees would set only a moderate crop from self-pollinated flowers.

It is usual, therefore, to interplant Gravenstein apples with two other varieties either of which will pollinate Gravenstein flowers and which, at the same time, pollinate each other. Combinations suitable for the Stanthorpe district are:—(*a*) Gravenstein, Delicious and Granny Smith; (*b*) Gravenstein, Delicious and Jonathan; and (*c*) Gravenstein, Jonathan and Granny Smith.

The interplanting of varieties does not, in itself, ensure a good crop; it merely eliminates faulty pollination as a possible cause of crop failure. Good orchard management is also essential and this involves efficient pruning, the use of adequate amounts of fertilizer, the adoption of tillage practices which prevent soil erosion, and systematic green manuring.

Pod Quality in French Beans.

By L. G. TRIM, Adviser in Horticulture.

The origin of the French or kidney bean is somewhat obscure, but the plant is probably native to an area extending from Mexico to Brazil, where a large number of species in the genus *Phaseolus* occur. The plant has, however, been cultivated for a very long time and innumerable strains and varieties existed in Peru even in prehistoric ages.

Market Requirements.

To meet the requirements of a selective market, the commercial French bean must combine good edible and keeping qualities with an attractive appearance. These characters are determined by the variety, soil fertility, seasonal conditions, incidence of pests and diseases, stage of maturity at harvesting and packing methods. Good prices may be obtained for inferior beans when the supply is inadequate to meet the demand, but in a competitive market only good quality pods are likely to return payable prices to the grower.

The main characteristics of quality pods are:—

(1) *Keeping quality.*—Beans which lose their colour and become dry soon after harvesting are not very attractive when offered for sale; this point is particularly important in consignments forwarded to Melbourne.

(2) *Fleshiness.*—A thin, flat, immature bean is a poor selling line in any market.

(3) *Colour.*—Pods with a pale colour do not carry so well as those which are dark-green when picked.

(4) *Evenness of shape.*—This is essentially a feature of an attractive pack.

(5) *Satisfactory fibre content.*—This should be sufficient to ensure good transport properties without detracting from the edibility of the pods.

Varieties.

No variety of French bean is equally good in all the foregoing characters; some excel in two or three and are indifferent so far as the others are concerned.

Brown Beauty, which is the most important commercial variety in Queensland, was discovered by Staley. It is known as Premier, Acme or President in some other parts of Australia. The pod is light-green in colour, straight or slightly curved, about 7 inches in length and contains 6 or 7 seeds. It is more or less oval in cross-section, and the top of the pod is long and sometimes slightly curved. Brown Beauty beans retain their colour well after harvesting.

St. Andrew's, which is a selection from Masterpiece, has a number of adherents in the Gympie district. The

Plate 1.

Pod Types in the French Bean. Top to bottom:—Brown Beauty, New Beauty, Hawkesbury Wonder, Richmond Wonder and Florida Belle.

plant is erect when young but somewhat spreading in the later stages of growth. This variety produces light-green fleshy pods which are long (about 7½ inches), narrow and slender, and straight to curved. The pods usually contain 6 seeds and are oval in cross-section. The chief defect in St. Andrew's is the tendency of the pods to lose colour rapidly after the crop is harvested.

Staley's Surprise was at one time grown extensively in southern Queensland but has now declined in popularity. It bears a prolific crop of long (about 8 inches), slender, slightly curved pods with a light-green colour and 6 to 8 seeds. The pods are oval in cross-section. The variety is rather more susceptible to anthracnose than some other commercial types, and as the long pods tend to rest on the ground, wastage is sometimes high.

Hawkesbury Wonder, a variety produced at Hawkesbury Agricultural College, has a fleshy pod which is long (about 7½ inches), wide and usually straight. It is oval in cross-section, medium-green in colour and has a smooth surface. The pods tend to lose colour after packing and this together with their greater width gives an "aged" look to consignments on the market.

Langshaw Beauty, which is a selection from Brown Beauty made in the Gympie district, has attracted favourable comment on southern markets. The pods are dark-green in colour, fleshy, round rather than flat in cross-section, and average about 9 inches in length. The plants require a good deal of room and are therefore planted at 10-inch spacings. If they are planted close together, growth is stunted and the pods rest on the soil, so some become badly curved and many are infected with the organisms responsible for wastage in transit.

Crop Management.

No variety of bean can be expected to produce good quality pods unless it is grown under the very best conditions in the field. Thus low temperatures adversely affect crops maturing in winter when chilling winds induce the formation of curled pods with undeveloped seeds, even though the vegetative part of the plant is apparently normal. Frost will, of course, kill the plant outright.

Under dry conditions, diseases are seldom troublesome but plant growth is retarded and the pods may be small, dry and stringy. On the other hand, wet conditions favour the development of anthracnose, halo blight, angular leaf spot and other diseases which cause a rapid deterioration in the crop.

For the commercial production of French beans, not only must seasonal conditions be good but the crop must be efficiently managed. During land preparation, organic matter should be incorporated in the soil wherever practicable. Summer green manure crops such as maize, panicum and cowpea which are used to recondition old bean land must be ploughed under some six weeks or so before the time scheduled for planting the bean crop. Otherwise, raw material in the ground may slow down the development of the beans.

Current fertilizer recommendations for the French bean are:—

Basal dressing—6 to 8 cwt. per acre of a 4-15-2 or similar complete mixture applied in the drill below the seed.

Side dressing—1 cwt. per acre of sulphate of ammonia applied in a band at the side of the row when the plants are 2 weeks old.

In dry weather growers with irrigation plants at their disposal should endeavour to supply adequate amounts of water to maintain soil moisture at levels which are sufficient for rapid plant growth. One good watering is more beneficial than two or more light

Plate 2.

French Bean Crop on the North Coast being Harvested.

applications at shorter intervals. On most soil types an application of 1½-2 inches of water every 10 to 14 days should be sufficient for the production of a crop in the absence of rain. Lighter applications only penetrate one or two inches into the soil and much of the water is soon lost by evaporation, particularly during the spring and early summer months.

Market returns from a bean crop are directly proportional to the efficiency of harvesting. If the pods are picked too early, they wilt rapidly in transit to market; if they are picked too late, seed development proceeds at the expense of pod appearance. It follows, therefore, that high quality beans can be marketed only when the crop is picked every three or four days.

Queensland Fauna Conservation Legislation.

"The Fauna Conservation Act of 1952."

By C. ROFF, Fauna Officer.

Interest in native animals and birds is deeply rooted in the minds and emotions of a broad cross-section of people. It manifests itself in such widely different individuals as those who enjoy indiscriminate shooting and those who are ardent naturalists and desire total protection for all living creatures. In a normal community a course between these two extremes is desirable.

Queensland has developed rapidly. Consequently, swamps which are the home of the waterfowl have been drained and natural haunts of other fauna have been destroyed. The numbers of hunters and trappers have increased, faster transport is available to remote areas, and generally there is more leisure time. All these have affected our wildlife.

Native fauna is at all times the property of the State, and the Department of Agriculture and Stock is responsible for conserving this fauna. However, the best commercial use should be made of our animals and birds and the legitimate needs of sportsmen must be met, but at the same time aesthetic values cannot be ignored. Furthermore, some of our wildlife may at times be a nuisance, others are pests in industries, and a few are carriers of disease of man and domesticated animals.

Obviously, fauna conservation is a complex subject covering several inter-dependent aspects such as wildlife studies, education and legislation. This article, however, will deal only with the legislative requirements of fauna conservation in Queensland.

THE DEVELOPMENT OF FAUNA LEGISLATION.

Originally, the right of man to hunt animals for food and sporting purposes was a natural one wholly unrestrained by law. With increases in human population it became necessary to abridge or restrict this natural right to ensure an adequate supply of animals for food. This early change in outlook was not sudden and over the centuries has evolved still further. To-day, in all civilised countries the taking of native fauna is, for most people, a controlled privilege and not an inherent right.

Fauna legislation was first introduced in Queensland in 1877, when certain game and insectivorous birds were protected. In 1898, further legislation was passed to provide for the introduction, acclimatisation and preservation of birds and animals deemed to be of economic value to the State.

In 1906, legislative provision was made partly protecting koalas and possums, and in 1910 greater restrictions were placed on the taking of these animals.

The first comprehensive Fauna Act was "The Animals and Birds Acts, 1921 to 1924," which listed the fauna to be covered by the Act, fixed periods of protection, prohibited the sale of, and prescribed open seasons for specified animals and birds, and declared lands to be sanctuaries.

This Act was replaced by "The Fauna Protection Act of 1937," which in due course was consolidated as "The Fauna Conservation Act of 1952." This current legislation was drafted to meet present-day requirements and was proclaimed on 1st January, 1954. It is divided so that interlocking provisions are combined under suitable part headings. This will facilitate administration and should help the public towards a clearer and therefore better understanding of fauna legislation. The Act will be discussed here under the various divisions.

DEFINITIONS.

It is provided that all actions, proceedings, sanctuaries and appointments made under the repealed "Fauna Protection Act of 1937" are legally continued under "The Fauna Conservation Act of 1952."

Various terms are defined and it is particularly important to note the following definitions:—

"*Appliance*"—Any means whatsoever used or capable of being used for the taking of any fauna or for facilitating or assisting in the taking of any fauna (including, but without limit to the generality thereof, any prohibited gun, air gun, firearm, other gun of any description, catapult, or other weapon from which any shot, bullet, or other missile whatsoever can be discharged, and any trap, snare, net, boat, vehicle or other conveyance, animal, bird, decoy, poison, bird-lime, explosive, implement, gear, or apparatus, and any lamp, flashlight, torch, or other artificial light of any description, and any shot, bullet, cartridge, or other ammunition of any description): Where any appliance is carried or otherwise kept in parts by two or more persons in company, each and every one of those persons shall for the purposes of this Act be deemed to carry, or, as the case may be, otherwise keep the appliance.

"*Bird*"—Any bird wild by nature, whether native, migratory, or introduced: The term includes any such bird notwithstanding that it is in captivity or tamed, and any species and individual members of birds within the meaning of this definition, and also the whole or any part of the skin, feathers, carcass, eggs, nest, young and offspring of any bird.

"*Mammal*"—Any mammal wild by nature, whether native, migratory, or introduced: The term includes any such mammal notwithstanding that it is in captivity or tamed, and any species and individual members of mammals within the meaning of this definition, and also the whole or any part of the skin, carcass, eggs, nest, young, and offspring of any mammal: The term does not, however, include any marine mammals or any mice or any rats (other than water rats).

"Take"—Used in relation to any fauna, includes hunting, shooting, killing, poisoning, netting, snaring, spearing, trapping, catching, pursuing, disturbing, stupefying, disabling, taking, plucking, injuring, destroying, or damaging that fauna, or attempting, causing, or permitting or assisting in any of those acts: (Where a person is liable under this Act to punishment for taking any fauna and that taking is constituted by that person having done, or having attempted to do, or having caused or permitted to be done, or having assisted to do, in relation to that fauna, any of the acts hereinbefore specified in this definition, then it is immaterial that the fauna in question shall not have been taken into possession either by the offender or by any other person whomsoever).

For legislative purposes fauna have been divided into the following classes:—

(*a*) Permanently protected fauna.

(*b*) Protected fauna (during certain open seasons specified protected fauna may be taken).

(*c*) Pest fauna.

The Act clearly indicates that all fauna until legally taken or kept are the property of the Crown.

Marine mammals, mice, rats (other than water rats), wild pigs, brumbies and domestic cats gone wild are not subject to this legislation.

ADMINISTRATION.

The Minister for Agriculture and Stock and certain officers of the Department of Agriculture and Stock are responsible primarily for administering the Act, and in addition other fauna officers and as many persons as deemed necessary for the conservation of fauna in any locality may be appointed as honorary protectors.

The credentials of a person desiring appointment as an honorary protector are important and accordingly it is necessary for each applicant to supply certain personal details and a suitable reference.

All members of the Police Force and persons occupying the following offices are, by virtue of their office, fauna officers.

(i.) Senior Adviser, Adviser, Assistant Adviser, Senior Inspector, District Inspector, or Inspector, in the Department of Agriculture and Stock, Queensland.

(ii.) Land Commissioner, Assistant Land Commissioner or Land Ranger in the Department of Public Lands, Queensland.

(iii.) Forest Officer under or for the purposes of "The State Forests and National Parks Acts, 1906-1948."

Fauna officers have right of entry to property and subsequent search. They may investigate and enquire, examine and seize and detain appliances and fauna, remove appliances and fauna, request names and addresses and verification thereof, stop any conveyance and request assistance from other appointed officers. Only members of the Police Force have power of arrest.

In respect of any person committing or suspected of committing an offence, an honorary protector may

(*a*) Require him to state his name and address.

(*b*) Require him to deliver up fauna or appliances.

(*c*) Take possession of fauna or appliances delivered up.

(*d*) Inspect licenses and permits.

(*e*) Request assistance from other appointed officers if necessary.

As far as honorary protectors are concerned, powers of interrogation only are provided. There is no provision for right of entry to property or for the primary seizure of fauna, weapons, etc., which may be received only if delivered up on demand.

It is an offence for any person to assault, obstruct, threaten, abuse, insult or intimidate an officer or honorary protector when carrying out duties under the fauna legislation.

Plate 1.

Sketch Map Showing the Approximate Boundaries of the Various Fauna Districts.

All kinds of fauna are not generally distributed throughout Queensland and therefore the State has been divided into six fauna districts (Plate 1). This allows conditions such as open seasons to be applied to a part or parts of the State without involving the whole.

[TO BE CONTINUED.]

The Supplementary Feeding of Sheep in Queensland.

Part 2. What Does the Sheep Do With the Feed It Eats?

By G. R. MOULE, Director of Sheep Husbandry.

Sheep have frequently been likened to mobile factories that harvest grass and make it into wool. It is true they do just that, but this may state the facts a little to simply. Too often we accept processes that are extremely complicated as being quite usual—although everyone will agree it is not at all unusual for sheep to grow wool!

But let us look behind the scenes to see some of the steps in the growth of one of the most important fibres in the world.

The sheep's first object in life is to survive. Therefore, the body functions essential for keeping it alive have first call on the available foodstuffs. These include such things as the muscular work of breathing and the beating of the heart, keeping warm and repairing muscle tissues, or building new blood cells to repair those which have been worn out.

The woolgrower's object in keeping sheep is to make them produce. To produce well a flock must have good average lamb-marking percentages and it has to produce heavy, high yielding fleeces. In most cases it has to do all this from the grass that nature provides. What's more, it has to take that grass and break it down into the simple substances it contains and then rebuild them into wool or the bodies of new lambs.

Composition and Use of Foodstuffs.

All foodstuffs are made up of different amounts of substances known as carbohydrates, fats, proteins, minerals, vitamins and water. Differences in the types of carbohydrates, fats, proteins, minerals and vitamins also occur. Each group of these substances perform certain functions in the animal's body. Correct feeding is based on a knowledge of these functions.

Carbohydrates.

Carbohydrates are made up of the chemical elements carbon, hydrogen and oxygen. The best known carbohydrates are sugar and starch. Maize, grain sorghum, wheat and oats are all foodstuffs used in supplementary feeding of sheep which are rich in carbohydrates.

Fats.

Fats also contain carbon, hydrogen and oxygen, though their proportions and the way they are arranged differ from that of carbohydrates. Carbohydrates and fats are used especially for the energy changes that take place

in the animal's body. They are in fact the chief "fuel" for the provision of energy in the body. They both fulfil a similar role but fat is about 2¼ times as valuable as an equivalent weight of carbohydrate. Linseed meal, cottonseed meal and meatmeal are the foods used for the supplementary feeding of sheep which contain the most fats.

Proteins.

Proteins are a much more complicated group of substances than the carbohydrates or the fats. Besides carbon, hydrogen and oxygen, they contain nitrogen and often such elements as sulphur, phosphorus and iron. Minute quantities of other elements are present in certain proteins. Like the fats and the carbohydrates, proteins can provide "fuel" which is converted into energy by the sheep. However, they have other more essential roles which they alone can fulfil. The minute cells which make up the sheep's body are composed mainly of proteins. Therein lies their main importance. Proteins alone can be used to repair or to make new cells, such as those that compose the sheep's muscle, its heart and its lungs.

Carbohydrates, fats and proteins can be used as a source of energy, but proteins alone can be used for the various phases of body building—for growth, for wool production, for milk production, for the production of semen and for keeping the body tissues in repair.

Proteins are also important because the hormones, substances secreted by the ductless glands, are also made from proteins. The glands that make hormones are the pituitary, the thyroid, the adrenals, the testicles and the ovaries. The hormones they secrete circulate in the blood. They control or influence practically every phase of the life and production of normal sheep.

Proteins, themselves, are not simple substances; they are made of building bricks known as amino-acids. The molecule of an amino-acid is simple when compared with that of protein, but it is complex when compared with a simple substance such as water. Being the building bricks from which proteins are made, amino-acids contain carbon, hydrogen, oxygen, nitrogen and sulphur. As they often include a large number of atoms in their make-up, their arrangement admits of many variations.

Twenty-five amino-acids are known to occur in living tissue, and one of them, cystine, is found in large quantities in wool. It is important to remember, however, that all amino-acids do not occur in all proteins. Therefore, it is necessary to arrange for proteins from more than one source to be included in the diet. This prevents any likelihood of a deficiency of one or more essential amino-acids. This may occur even when the level of total protein intake appears to be sufficient in quantity to provide the protein required for both the maintenance of the body's tissues and production. In other words, the quality of the protein is as important as the quantity.

The chief protein-rich foods used in supplementary feeding of sheep include such things as linseed oil meal, cottonseed meal, meatmeal and bloodmeal.

Minerals.

The mineral content of foodstuffs is important. It influences the functioning of the blood and of the nerves and provides for the development of good strong bone, sound teeth and normal wool.

The minerals known at present to be of the greatest importance are calcium (lime), phosphorus, magnesium, copper, iron and cobalt. Sufficient lime and phosphorus, and to a lesser extent magnesium, are essential for the development of strong bones and sound teeth and they also influence growth rate.

During the process of digestion, minerals are absorbed through the walls of the small intestine and enter the blood stream. This carries them to various parts of the body. The calcium, phosphorus and magnesium

are used mainly for the development of bones and teeth but the calcium and magnesium are also important for the normal working of the nerves and muscles.

Incidentally, the bone is not a static tissue. It provides a solid supporting framework, but also acts as a mineral storehouse and it changes its "stocks" continually.

Minerals are excreted mainly in the urine which passes through the kidneys. They are also secreted through the lower bowel.

Iron and copper are stored mainly in the liver. These minerals are used extensively in the formation of red blood cells by the red marrow in the long bones. Copper has also a number of other important functions in the body. One of the chief of these is the development of normal character in the wool. In areas where sheep are suffering from copper deficiency, the wool lacks character. However, adding a small amount of copper to the diet of sheep ensures that they produce a stylish wool which has a clearly defined character. Copper is also necessary for the development and growth of normal nerves in young lambs.

Cobalt is one of the most interestng minerals essential to sheep. It is not even accurate to say that the cobalt is essential to the sheep! It is used mainly by the bacteria and other organisms which live in the sheep's paunch. They take the cobalt and form it into an essential vitamin known as B_{12}. In the absence of this vitamin the marrow in the long bones is unable to make normal red blood cells. Therefore, if the sheep are not given sufficient cobalt they soon become very anaemic (that is, they suffer from a lack of sufficient red blood cells).

A small amount of lime circulates in the blood. Its function is to keep the heart beating with its usual rhythm and to make sure that the nerves carry their messages to the muscles they serve. If the level of lime circulating in the blood suddenly drops, as sometimes happens in the case of ewes at lambing time or when sheep are fed for a long time on a lime-deficient diet, the muscles lose their normal responses to messages from the nerves. This condition is quite common in Queensland and is known as milk fever.

Vitamins.

Vitamins are chemical substances which occur in small quantities in some foodstuffs. Their main function is to keep the sheep's body in good health. Various animals have different vitamin requirements.

Vitamin A appears to be the most important one from the point of view of supplementary feeding of sheep. It is derived from certain pigments found in grass, leaves, yellow maize and fresh, good quality lucerne hay. It is stored in the liver and therefore liver oils are very rich in vitamin A. If sheep have to eat feed which is deficient in vitamin A for a long period they may suffer from important disorders such as infertility and stone in the bladder.

Water.

All foodstuffs contain a certain amount of water. It may be quite important to know how much water is present in the feeds that can be used in supplementary feeding when high freight charges are likely to be incurred.

Dry Matter.

A knowledge of the dry matter which is left in the foodstuff after the water is extracted is useful in working out the amount of a supplement that sheep can eat. Correct feeding demands that the animal's appetite be satisfied and that adequate nutriments be included in the ration. Supplementary feeding should aim as much as possible at providing nutriments that are abesnt from the ration or which are present in insufficient quantities. In many cases in Queensland, supplementary feeding could help the animal use a fair amount of the dry fibrous grass that is available.

Fibre.

Some foodstuffs contain more fibre than others. Dry Mitchell grass standing in the paddock is particularly high in fibre content. Certain grains, such as oats, have a fibrous husk and so contain more fibre than the equivalent weight of maize. Much of this fibrous material is broken down into simpler and more readily digestible substances by the bacteria that live in the paunch. It has been shown recently that these bacteria are extremely important in the supplementary feeding of sheep. The prudent feeder will endeavour to stimulate them so that they will help the sheep to handle the fibrous material standing as "hay on the stem."

MANAGING IRRIGATED PASTURES IN SUMMER.

Though an irrigated pasture produces heavy yields of forage, its year-round productivity is governed by the way in which it is managed. Satisfactory summer production depends on careful grazing.

Mr. A. Nagle, Irrigationist in the Department, has reported that where pastures have been grazed very short during summer there has been a reduction in the stand and a corresponding decrease in pasture production.

The temperate-climate pasture species, which are the major components of irrigated pastures in Queensland, are adversely affected by hot weather. High temperatures seriously retard the growth of cocksfoot and phalaris and may even kill white clover and ryegrass. When this happens, bare patches appear in the pasture and provide easy access for the invasion of inferior species. Productivity of the stand then declines.

On the bare ground, soil temperatures in summer may be as high as 150 or 160 degrees, but under a good cover of leafy pasture the temperature may be as much as 30 degrees cooler.

Officers of the Department have determined that a ground cover of pasture 3 in. to 4 in. high will keep the soil sufficiently cool in summer to permit the components of the sward to continue growing.

It is also known that effective summer management of irrigated pastures is easier when a sub-tropical grass such as paspalum is incorporated in the pasture. Paspalum will grow vigorously in the summer, but if it is managed carefully, both by grazing and by mowing, it can be kept at 3 in. to 4in. high, thus insulating the soil against the summer sun but not suppressing the clover growth.

Where strip grazing is practised there is a tendency to overgraze the pasture in an endeavour to make use of the forage. Trials indicate that, in summer, stocking rates should be reduced so that a lighter grazing will leave the essential ground cover of pasture.

Farmers whose pastures might have declined during the past summer should take notice of this information as a guide to pasture management in the future.

ANIMAL HEALTH

Vibriosis of Dairy Cattle.

By B. PARKINSON, Divisional Veterinary Officer.

If you are having trouble with abortions or sterility in your herd, vibriosis may be the cause.

In this disease, abortions usually occur when pregnancy is 3-6 months advanced. Sterility is usually associated with irregularity of heat periods.

This article describes how the Department of Agriculture and Stock assists you to diagnose vibriosis, and how control and treatment may be attempted.

Overseas the disease commonly called vibriosis has long been recognised as a cause of abortion and sterility in cattle.

Since 1948 it has been recognised as a potential source of danger in Queensland, mainly to dairy cows, and it appears the disease has become more prevalent in the last few years than it was five or more years ago. This increase in prevalence is debatable, it being quite probable that the disease was just as widespread in the past and is receiving greater attention now only because of improved methods of diagnosis.

The disease in cattle was first recognised in England in 1913 and in America in 1918, but the first Australian diagnosis was not made till 1942 in New South Wales. The occurrence of vibriosis in Queensland was first recorded in 1949, when three cases of bovine abortion due to this infection were reported as having been investigated in that and the previous year. Since then, the disease has been diagnosed in most dairying areas of the State. There have also been many suspected outbreaks.

CAUSE.

Vibriosis is caused by a germ, *Vibrio fetus,* which when viewed through the microscope appears as a comma, "S" shaped or occasionally spiral-shaped body. The germ is motile (that is, able to move of its own accord) and hence can spread in suitable body tissues. It is capable of infecting sheep as well as cattle.

HOW INFECTION OCCURS.

V. fetus lives in the genital tract of affected animals and is spread from bull to cow, or vice versa, during service. In most herds where recent infection has taken place infection can usually be traced to the introduction of an infected cow or bull. The bull is the main means of spread of the disease and once he becomes affected and is continually used in the herd he remains a potent source of infection of the rest of the herd.

Occasionally a virgin heifer is found to be infected, but this is rather an exception, as transmission by service accounts for practically all spread.

Methods of spread other than by service remain uncertain at present.

When a bull is infected, it is usually found that his semen contains the germ; thus the disease can be transmitted by artificial insemination if semen from an infected bull is used. Susceptible animals can be infected readily by placing the organism in the genital tract of either the cow or the bull.

HOW THE GERM ACTS.

V. fetus infection is primarily a disease of the placenta or foetal membranes (that is, what is commonly called the after-birth when it is expelled following a normal calving or an abortion). As a result of the damage to these membranes there is interference with the supply of blood from the dam to the developing calf and the latter suffers from lack of proper nutriment.

In many cases detailed examination of the lining of the uterus reveals damage caused by the germ in this situation also.

The germ does not appear to produce any symptoms in the bull and his role is only as a carrier of the infection.

SYMPTOMS.

The presence of vibriosis in a herd may be indicated by sterility or abortions or both. Its presence is shown only in the cows, in the form of abnormalities such as irregularity of the oestrus cycle, changes in the structure of the breeding organs, early death and absorption or expulsion of the foetus, late abortions, birth of weak or dead calves at full term, and the retention of the placenta.

This complete range of symptoms is seldom seen in a single herd, and even if all were present, many of them would probably escape the untrained eye not on the alert for the disease. The usual story in Queensland is that a farmer requests assistance in correcting his herd's sterility problem or in eliminating abortions that occur from time to time.

The symptoms stated above are not diagnostic of vibriosis, as many of them are seen in two other diseases producing sterility and abortion in cattle. These are brucellosis or contagious abortion (caused by the germ *Brucella abortus*) and trichomoniasis (caused by a protozoan or single-celled parasite, *Trichomonas foetus*). Consequently from the happenings in the herd alone it is often impossible to determine what infection is causing the trouble in that herd.

Vibriosis was first suspected and diagnosed in herds in Queensland where abortions were occurring fairly commonly, but in which, because of their relative freedom from brucellosis, the latter disease was an unlikely cause. In some herds, heifers which aborted had been vaccinated with Strain 19 against brucellosis.

Before Strain 19 vaccine was used extensively, many abortions which may actually have been due to vibriosis were probably passed off as being due to brucellosis, but the occurrence of abortions in Strain 19 vaccinated cattle prompted a much wider investigation into the problem. These investigations showed that Strain 19 vaccination was not at fault, but that in fact, previously unsuspected vibriosis was often responsible for the trouble.

Actually, quite often brucellosis and vibriosis occur in a herd at the one time, and unless one is careful, the latter disease may be overlooked. In these cases, the incidence of brucellosis is usually not sufficient to account for the severity of the herd problem and as a result the presence of the other disease is suspected.

When a veterinary surgeon is called to investigate breeding problems in a herd, it is highly desirable that the farmer have available an accurate breeding record of all cows and bulls present. This goes a long way in aiding the veterinary surgeon to make a diagnosis.

With vibriosis under Queensland conditions, sterility as a herd problem is usually well marked. Occasionally abortions occur, and while these may be at any stage of pregnancy, 3-6 months is commonest. It is rare for the abortion rate to exceed 10-15% of the pregnancies and the figure is usually lower than this.

The occurrence of the oestral cycles must be taken into careful consideration, as affected cows often return to service at very irregular intervals. For instance, in one herd investigated, the length of the cycle varied from 8 days up to 3 months. In the latter cases, it is likely that conception occurred, but death and absorption of the foetus, or early abortion (undetected), resulted in return to oestrus. Sometimes abnormal discharges are observed following oestrus.

Usually three or more services are necessary to settle infected cows in calf, but many cows return for months without conceiving. Some may remain permanently sterile.

Examination suggests that there is more rapid deterioration of semen quality in an infected bull than in normal animals and fertility may be somewhat diminished.

DIAGNOSIS.

Positive diagnosis of vibriosis very often constitutes quite a problem. As brucellosis is still a major cause of sterility and abortion, particularly in unvaccinated herds, it is desirable to eliminate this disease as the cause of the trouble. A reliable blood test is available for the diagnosis of brucellosis and usually this is the first step undertaken in a herd under investigation.

However, if brucellosis is present, care should be taken to ensure that the possible presence of other disease is not overlooked, as brucellosis may not alone be responsible for the problem.

The methods of examination and diagnosis for vibriosis are as follows:—

In the Cow.

(1) If abortions are occurring in a herd, examination of a freshly aborted foetus is the most reliable method of determining the presence of the disease. Until recently, it was the only available method.

The reliability of the method is considerably lessened when specimens are decomposed. This is because the organisms tend to die out rapidly, particularly in the presence of other contaminating germs, which nearly always invade an aborted foetus. Consequently, a negative examination does not always indicate freedom from infection.

The causative organisms are quite plentiful in a fresh foetus and specimens submitted for examination (if the foetus is too large to send in its entirety) should include the stomach and contents (tied off) and lungs. Usually the organisms can be seen quite readily under the microscope in stained smears of fresh material, but if necessary, cultural examination of the germ may be undertaken.

(2) A serum agglutination test, involving a test on blood serum similar to the one used for brucellosis, may be used. Although not as reliable as the latter, the presence of several positive reactions to the vibriosis test in a number of tested cows may usually be taken to indicate the presence of the disease, or at least to indicate that further investigation is warranted.

A negative reaction to the test does not necessarily mean that the beast is not infected with vibriosis, because the agglutinins (bodies in the blood stream which cause a reaction to the test) do not last for long. After initial infection (as indicated by abortion or commencement of return to service) they are soon at their peak, but rapidly subside till in about 3-5 months or maybe even less the reaction may be negative.

The test is of greater value in herds in which assistance is called for soon after the commencement of trouble than in those in which the trouble is of long standing.

Usually if an initial bleeding to determine the incidence of brucellosis is made, it is requested that a test be undertaken for vibriosis on all cows which have aborted or are sterile. Positive reactions in these animals are usually considered diagnostic of vibriosis.

(3) In the mucus agglutination test, a similar procedure to that applied to serum is used, but in this case mucus procured from the vaginal (breeding) passage is tested.

This test is recognised as being more accurate than the previous one but still has its disadvantages. A positive reaction may commence about 1-2 months after initial infection and persist for approximately 7 months. Positive reactions to this test can usually be taken to indicate definite infection in affected beasts, but a negative reaction may possibly be false.

The specimen is obtained using a special pipette, which is inserted into the vaginal passage and the mucus sucked into the tube, using a rubber bulb. About 2-3 cc. are necessary.

Ideally the mucus sample should be taken midway between heat periods (mid-oestrus), as a greater concentration of agglutinins is then present, but very often, because of the dry nature of the passage at this stage of the oestral cycle, it is difficult or impossible to do so. An increased flow of mucus takes place around oestrus, but this is rather unsatisfactory for testing, as the great increase in quantity usually dilutes the agglutinins, giving an insignificant reaction.

In one herd, an analysis of results obtained from infected animals showed that of samples collected at oestrus only 21% showed a reaction, whereas 91% of samples reacted when taken at other times.

(4) Growing the germ in the laboratory from mucus samples obtained as above may be attempted.

This test is also unreliable because the tendency of the organism to die out easily and the unavoidable presence of contamination with other germs may often give a false negative result.

In contrast to the previous test, however, best results with the cultural test are obtained when samples taken at oestrus are used. A similar analysis of results in the herd referred to above showed 83·1% of oestral samples positive on culture, whereas only 26·5% of samples collected at other phases of the cycle were positive.

In the Bull.

(1) The serum agglutination test for the bull is the same test as that applied to cows. It has similar disadvantages in that the reaction to the test may only be of short duration after initial infection. As the bull is in contact with all cows in the herd, he is most prone to be infected, and because of this it is always wise to submit him to this test. The test is of greater reliability with an early infection in a herd than with one of a long-standing nature.

(2) Culturing the germ from scrapings may be attempted. A special pipette has been devised for the taking of scrapings from the prepuce (sheath). Because of the presence of contaminating germs, effective examination is again very often made difficult. It is sometimes possible to detect infection by culturing the organisms in semen obtained from an infected bull.

(3) Test mating of the bull to virgin heifers or known clean cows and examination of these (for several months) using the methods outlined previously is the most reliable method of diagnosis, though it would be impracticable to use this as a routine field test.

No Method Satisfactory.

It will be seen from the foregoing that no one method is completely satisfactory in obtaining a positive diagnosis of vibriosis. Both males and females in the herd should be tested by a combination of the above tests when brucellosis or other obvious abnormalities have been eliminated as a cause of the trouble.

If vibriosis is present, particularly if it is an early infection, it is usually possible to get a positive result for one or more of the above tests. Some of these tests are similar to the ones applied to detect trichomoniasis and at the same time it is the usual practice to see if this disease is present also. To be really certain of the diagnosis, demonstration of the actual organisms by culture is the only completely accurate test.

CONTROL.

Control in an infected herd presents a difficult problem. The methods available are as follows.

(1) Natural immunity within a herd is sometimes rapidly obtained. In many cases, particularly if the infection is of long standing, it may be best to do nothing.

The usual history in an infected herd is that initially the sterility problem is rather acute and may be affecting most of the cows. After a few months, it becomes less acute and the majority may finally conceive, most of the cows carrying their calves to full term. This is because a natural immunity is built up and a herd which is troublesome now may show quite good conception rates for the mature cows 12-18 months later.

However, in such a herd, persistent trouble each year may be experienced with the virgin heifers, particularly if the one bull is used, or when previously normal heifers after their first calf go to the herd bull.

(2) Complete sexual rest of the entire herd for 3-4 months is often advised.

V. fetus usually dies out rapidly in cows unless it is being continually reinforced by infection from the bull. After 3-4 months without service, it usually happens that the infection has disappeared in cows. After the sexual rest, a clean bull is used to settle the cows, as infection in bulls is not readily thrown off.

It is always wise to use a young clean bull on the heifers and subsequently on all cows which have had a normal calf. In this way it is usually possible to clear up the disease fairly readily, but good management and the keeping of records is necessary.

(3) Use of a theoretical two-herd system is helpful.

One herd, the infected herd, consists of all cows which are giving trouble. The infected bull is used in this herd to settle what he can in calf. All cows that carry a normal calf to full term should be given complete sexual rest for three months, after which there is every chance of the infection dying out. These can then go into the clean herd.

This second herd comprises only virgin heifers or known clean cattle. A young clean bull is used on this herd.

Theoretically, it is a two-herd system, but actually it is a two-bull system, as the cows are run together, the bulls confined, and mating controlled to the desired bull. Accurate records are essential.

This system of control relies on the fact that the disease is to all intents and purposes wholly venereal (that is, spread by service only) and transmission from cow to cow does not occur. In view of the practical difficulties involved, this method could only be used in herds with very high standards of management.

TREATMENT.

The *V. fetus* germ is susceptible to present-day antibiotics such as penicillin, streptomycin and aureomycin. Penicillin and streptomycin either alone or preferably in combination can be quite economically used to treat infected cows.

Treatment is often advantageously used in conjunction with the control methods recommended above, particularly to treat cows in the infected herd which prove difficult to settle. This enables them to carry a normal calf and have three months' sexual rest, after which they can be considered clean.

The drugs are administered by special catheter or tube directly into the womb, a technique which can only be carried out by an experienced operator.

STUDYING EFFECTS OF LIGHT ON MERINOS.

The effects of increasing and decreasing hours of daylight on the physiology of Merino rams is being examined by officers of the Sheep and Wool Branch of the Department of Agriculture and Stock.

The findings of this investigation, said the Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.), may give a valuable lead in the vitally important task of determining ways and means of increasing lambings in tropical Queensland.

Low lamb-marking percentages in flocks in the tropical north-western sheep-raising lands of Queensland have worried wool-growers for many years. A systematic investigation of all the factors which may affect the fertility of rams under north-western conditions is being carried out by the Sheep and Wool Branch. The present experiment is a continuation of this work.

In attemps to track down the reasons why the number of lambs born to ewes mated is low, officers of the Sheep and Wool Branch, headed by the Director of Sheep Husbandry (Mr. G. R. Moule), are examining nutritional factors leading to low lambings. Improved husbandry practices are increasing the number of lambs reared to marking age. These practices are now a standard recommendation to wool-growers.

Overseas research workers have established that the fertility of certain British breeds of sheep is markedly affected by variations in the hours of daylight. Both fertility and desire to mate are greater when the hours of daylight are decreasing.

In the experiment being carried out in Brisbane, six rams have been kept during the autumn under naturally occurring conditions of decreasing daylight, while six others have been subjected to steadily increasing amounts of light. By midwinter, the control group will be receiving natural daylight of 10 hours 42 minutes a day, and the experimental sheep will be receiving light for 14 hours 35 minutes. Fertility of both groups will be continually checked during the experiment. Their desire to mate will also be examined at intervals.

It has been reported that the rate of wool growth of British breeds varies with the hours of daylight. In the experiment, wool growth in the Merino under increasing and decreasing hours of daylight will be measured.

At the conclusion of this experiment it is proposed to use another group of rams to carry out further studies into the effect of temperature on the fertility of Merino rams.

Mr. Collins said it is hoped that this research, which is being financed by the Commonwealth Wool Research Trust Fund, will help to find an answer to some of the problems of sheep breeding in the tropics.

Successful Hatching.

By C. H. SMITH and F. N. J. MILNE, Poultry Branch.

A recent survey of some of our Queensland hatcheries produced the disturbing fact that the hatchability of all eggs set ranged from 66% to 85%. Such a wide range in hatchability cannot be accepted complacently.

What is the cause or causes of this variation? Is it due to faulty incubation, incorrect feeding or poor fertility?

INCUBATION.

The Three Essentials.

The fundamental object in incubation is to get the largest possible number of chicks in proportion to the number of eggs set. To do this it is essential to provide the eggs with the most favourable environment, so that normal embryonic development may take place.

It does not really matter if modern electric machines are used, or the older type kerosene-heated models, so long as the three main factors in incubation are carefully considered — warmth, ventilation and moisture.

The Chinese hatcheryman, still using his old antiquated methods of incubation, can hatch chicks almost as efficiently as the most modern machine working alongside. Why? Because the three main essentials for successful incubation mentioned earlier are provided by the Chinese hatcheryman.

It is one of the marvels of nature that in a matter of three weeks the minute transparent spot on the surface of the yolk can develop into a fully formed chick. For this development to take place, many factors are responsible, and each one is a necessary link in the chain of successful incubation. Should one link be missing the result will be failure of the eggs to hatch or at best a weak sub-normal chicken.

Temperature.

The normal temperature of a fowl varies from 105° to 107°F. Incidentally, it's generally thought that the temperature of a broody hen is above normal. This isn't so, for the "broody's" temperature is usually 2°F. below normal, averaging about 103°F.

With the kerosene-heated incubators the heat radiates from the top downwards on the same principle as when a hen is sitting on eggs. Consequently, the tops of the eggs are warmer than the underneath surfaces. There is also the possibility of variation in the warmth supplied to eggs on the same level. Hence, in these machines, the eggs must not only be turned, but the eggs on the outskirts of the tray must be moved to the centre and vice versa to compensate for any variation in temperature.

The thermometer in this type of machine is placed so that the bulb is just above the tops of the eggs and should show an operating temperature of 103°F. You will remember this is the temperature of a broody hen.

The heat distribution in electric machines differs from that in the kerosene heated types, for heat is circulated inside the egg chamber by means of revolving fans, and the temperature remains relatively uniform at about 100°F. As most poultry breeders are aware, variations from the temperatures stated above can have a disastrous effect on hatchability.

If the temperature is too high the effects are: (1) chicks will hatch too early; (2) a high percentage of dead in shell; (3) some chicks stick in shells and have to be helped out. Too low a temperature can also affect hatching eggs and results in delayed hatches and abnormal embryos.

Moisture.

While eggs are being incubated they lose moisture through evaporation. This loss under normal conditions varies between 11% and 13%. If too much drying takes place, hatchability will be poor and the chicks which do hatch are small. On the other hand, too much moisture produces sticky, "mushy" looking chickens often with the navels incompletely healed.

The evaporation rate depends on the moisture content of the air and air movement. The moisture content of the air is related to temperature and the percentage of water-vapour in the atmosphere at a given temperature is known as the "relative humidity."

The higher the temperature, the more water-vapour the air can hold. For example, at 70°F. and relative humidity at 100% ("saturation" point), 1,000 cubic feet of air would hold 1.533 lb. of water, but at 100°F., the same volume of air would hold a maximum of 2.885 lb. of water at 100% relative humidity.

Pans of water are put into the incubator to increase the amount of water-vapour in the machine and so slow down the evaporation rate from the eggs.

The simplest method of estimating the relative humidity in incubators is by comparing the readings of "dry-bulb" and "wet-bulb" thermometers hung in the cabinet of the machine.

Electric forced draught incubators generally operate most efficiently at a relative humidity of 60%, shown by readings of 100°F. on the "dry-bulb" and 88°F. on the "wet-bulb" thermometers. There may be slight variations according to the make of the machine.

For the last three days of the hatch, the relative humidity should be increased to 70%, with "dry" and "wet" bulb readings of 100°F. and 91°F. respectively.

As soon as most of the chicks have pipped the shell, the relative humidity is reduced again to 60% (dry bulb 100°F., wet bulb 88°F.) in order to "dry off" the newly hatched chickens.

The relative humidity is raised or lowered by suitable adjustments to the inlet and outlet "ports" in the incubator.

Ventilation.

As the embryo is developing within the egg, it is constantly taking in oxygen and giving off carbon dioxide gas. While it is impossible to have too much oxygen, too much carbon dioxide will drastically reduce hatchability. It is obvious, then, that the incubator room and incubator must be ventilated sufficiently to allow the escape of excess carbon dioxide gas.

Kerosene-heated incubators if housed in badly ventilated rooms give off fumes from the lamps, which may in turn re-enter the egg chamber and thus suffocate the embryo. However, modern incubators housed in suitably ventilated buildings are unlikely to give trouble from this cause.

During incubation, eggs are tested for fertility on the seventh day and all infertiles are removed.

Watch the Directions!

Although the foregoing are the fundamental factors in successful incubation, it is always advisable to follow closely the manufacturer's instructions for each make of machine. No two machines are exactly the same, and therefore may need slight adjustments according to local conditions.

Saving Eggs for Incubation.

Abnormally shaped, thin-shelled eggs should not be used for incubation. The best results are obtained when eggs no older than seven days are used for hatching. If eggs have to be stored for more than a week, then it is essential to turn the eggs each day to prevent the germ on the yolk rising and sticking to the shell membrane and causing the death of the embryo during incubation.

It is also important that the eggs be held in a cool room prior to incubation, for embryonic development will commence when the temperature reaches 68°F. An ideal temperature for the room would be 50°F.

Turning Eggs.

In normal practice eggs are turned only two or three times a day from the second to the eighteenth day. In this regard, we are not as industrious as the hen, for she turns her eggs at least hourly day and night.

Interesting reports from Holland indicate that more frequent turning of eggs will produce better hatchability, and several large hatcheries over there are now equipped with automatic devices on incubators to turn the eggs hourly.

With kerosene-heated incubators, the egg trays are taken out of the machine when the eggs are turned by hand, as turning the eggs allows a more equal distribution of heat. Ventilation is not the best in these incubators, so removal of the trays for egg turning provides a means of cooling and airing.

With electrically heated incubators, stale air is being constantly replaced by fresh air with the aid of revolving fans. It isn't necessary to open the doors, for turning is done by simply shifting a lever which automatically tilts the contents of each compartment.

FEEDING FOR HATCHABILITY.

Vitamins and minerals have a very large bearing on successful hatching. One may go so far as to say that in the majority of cases of poor hatchability it is the ration fed rather than faulty incubation which has been responsible.

Vitamins.

Riboflavin.—The riboflavin in the feed definitely influences the riboflavin content of the eggs, which in turn influences the livability of chickens.

Riboflavin deficiency in the breeders' ration causes retarded growth of the embryo, curled toes, incomplete yolk absorption, scarcity of down and in some cases "clubbed" down, which means that the down has not erupted through the skin, which looks like "goose flesh."

Riboflavin is not required for layers and this is the major difference between layers' rations and breeders' rations. Naturally, laying mashes are cheaper than breeders' mashes because the more expensive riboflavin-rich foods such as livermeal, buttermilk powder and whey powder are omitted. The use of a layers' mash in place of a breeders' mash containing any one or all of these ingredients has caused poor hatchability in our State.

Synthetic riboflavin is now available and is used extensively. It is pleasing to note that many of our hatcherymen are now wide awake to the possibility of a riboflavin deficiency and take no chances; some even add it to rations designed for breeding birds.

Vitamin D_3.—The role of vitamin D_3 obtained from either sunlight or certain fish oils is bound up with the utilisation of calcium, phosphorus and manganese. Without this vitamin, calcium and phosphorus could not be linked to form the hard substance we

call bone. Perhaps no other vitamin deficiency can have such an immediate effect as a lack of vitamin D_3 in the breeders' ration.

Vitamin A.—Vitamin A does not directly affect hatchability as riboflavin does, but its effect is more far-reaching. Some time ago cases of deaths in week-old chicks were occurring on two farms. It was only when it was found that breeding birds were not getting sufficient vitamin A that the cause of these recurrent heavy losses was found.

Liver assays have since been conducted and the low status of vitamin A in some of the young chickens brought to the Animal Research Institute would indicate that closer attention must be paid by hatcherymen to the vitamin A needs of their breeders.

Pantothenic Acid.—Normally a deficiency of this vitamin is not encountered but it is more than likely in those rations where livermeal, milk powder or whey powder is not used. The lack of this vitamin does not produce the abnormalities caused by, say, manganese or riboflavin, but it can lead to poor livability in the hatched chickens.

The thought occurs that some of our poor rearability is possibly due to too much false economising with the breeders' rations by eliminating relatively costly milk powders and livermeals and depending entirely on synthetic riboflavin.

Vitamin B_{12}.—You are aware that there are two types of protein—animal and vegetable. Vegetable protein, of which we have very little, will support egg production but not hatchability.

Animal protein will give good hatchability because it contains the Animal Protein Factor complex, the most important constituent of which is vitamin B_{12}. The richest natural source of this vitamin is livermeal, followed by buttermilk powder, with meatmeal well down the list.

Those chickens which hatch from B_{12}-deficient eggs are unthrifty and the death rate is high.

Livermeal—a source of the vitamin-B complex.—You will see that livermeal has been ranked first as a supplier of riboflavin, pantothenic acid and vitamin B_{12}. In fact, it is one of the richest natural sources of the vitamin-B complex and it is thought that the use of livermeal at the extremely low rate of only 4% of a breeders' mash will cover most of the vitamin requirements of the bird with the exception of vitamins A and D_3.

GOOD FERTILITY.

Too many "clears" or infertile eggs when tested by candling on the seventh day of incubation indicates that flock fertility is at fault.

Fertility is influenced by (*a*) the condition of the flock, (*b*) the age of the breeding birds, (*c*) seasonal conditions, and (*d*) too few or too many male birds.

The Condition of the Flock.

In both males and females fertility initially depends on good health, and this can only be gained by supplying enough feed to maintain body weight in both males and females and by ensuring that all food factors are present in the feed we give.

It is difficult to differentiate between the requirements for flock fertility and hatchability, because without fertility there can be no hatchability. Bear in mind that what has been said for improving hatchability applies equally to fertility.

The Age of the Breeding Birds.

Ordinarily the older the breeding birds (both male and female) the lower is the fertility. For this reason, chicks from matings using second-year or older birds are more costly to produce.

The use of cock birds with pullets can also result in lower fertility. A point which is often overlooked when using old males is that excessively long spurs may injure females and hinder mating. Such long spurs should be trimmed before "mating-up."

Seasonal Conditions.

Very hot or very cold weather lowers fertility. In Queensland, fertility is more likely to be affected by hot weather. One American worker showed in 1944 that as the maximum day temperatures increased from 82·8°F. to 101·8°F., the percentage of fertile eggs laid declined from 94 to 68.

Number of Males.

If too few males are used in a flock, the cockerels seem to show more interest in fighting than mating. This can also occur if too many males are used. With light breeds, one male should be used to every 15 to 25 females. One male to every 13 to 20 females should be used in the case of heavier breeds.

TRIALS ON KAPOK BUSH.

Kapok Bush, an accidental introduction, is at present attracting considerable attention as sheep fodder in north-western Western Australia.

Nothing is yet known about its behaviour in Queensland. Therefore, it will have to pass strict tests to show that it can make a worthwhile contribution to the pastoral industry without becoming a serious pest in other sections of the State before it can be recommended as a pasture plant for Queensland.

Stating this recently, the Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.) explained that, for some time, officers of his Department have been closely following the work done with the plant in Western Australia. This perennial plant grows readily in the semi-arid 10 in. to 12 in. rainfall lands of north-western Western Australia, and because of its strongly-developed root system it is able to survive even severe droughts.

Kapok bush, a native of tropical Asia, derives its common name from the fact that its woolly seeds are used as mattress fillings by Malayans. It is believed to have become established in Western Australia by chance in 1930 after seed had escaped from a Malayan diver's mattress.

The plant first became established in coastal districts, but has spread rapidly during the last four or five years.

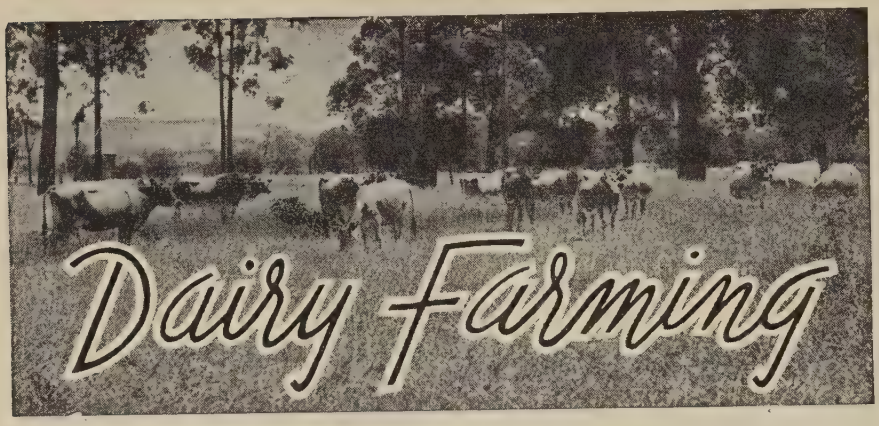
Analyses of the leaves indicate that kapok bush may have a high protein value, and for this reason it is gaining popularity among wool-growers in the north-western areas who are seeking protein-rich plants to improve their pastures.

Cattle breeders, however, fear that the large quantities of woolly seeds the plant produces may cause felt balls in cattle. The Western Australian Department of Agriculture has arranged feeding trials using the whole plant, including the seeds, to find out if the plant has any harmful effects on cattle.

For trials in Queensland, planting material was obtained by Mr. S. Marriott, Senior Agrostologist in the Department, during his recent inspection of Western Australian pastures. The plant will be grown under strict quarantine while it is studied by pasture workers.

Kapok bush is a member of the same family as the common Queensland weeds Prince of Wales Feathers and khaki weed. In trials it must be determined whether the plant, under the relatively better rainfall conditions in Queensland, will become a weed which will suppress valuable pasture species already established.

Because its value or otherwise as a cattle fodder has not yet been established, and because it is related to well-known Queensland weeds, it is stressed that plantings of kapok bush in Queensland should be deferred until feeding trials in Western Australia and field trials in this State have been completed.



Dairying in the Netherlands.

By L. E. NICHOLS, Dairy Research Branch.

Dairying has from ancient times been one of the principal industries in the Netherlands. This feature is not attributable exclusively to the conditions of climate and soil, but also to the favourable economic situation of the country in Western Europe, bounded as it is by the northern and southern countries of the continent.

Land Utilisation.

The Netherlands, a flat fertile country of 13,202 square miles, is devoted to intensive agriculture for most successful dairying. Three-quarters of the cultivated area in this country is used for livestock-farming purposes (55% for dairy farming), 20% for arable cash-crops and 5% for horticulture.

One-third of the country is below sea-level and water must be continuously pumped from field ditches to drains and main canals. The picturesque windmills are giving way to power-operated units but the drainage system remains the same. This reclamation of lowlying land and its development to the foremost dairying country of the world is one of the greatest agricultural achievements of modern times.

Despite setbacks, such as the encroachment of the North Sea into some of the polder country during the 1953 flood disaster, the Netherlands is most densely populated, has the highest yield of most temperate-zone crops per acre, and has the highest production of milk per cow in the world.

Pastures.

One-third of the country is under permanent pasture comprising perennial ryegrass, meadow fescue, timothy grass, meadow grass, Italian ryegrass and cocksfoot. Leguminous plants such as red clover and white clover also occur.

Nitrogenous and phosphatic fertilizers and lime are freely used in the topdressing of soils. The average carrying capacity is 1½ cows per acre, and the average number of cows per farm is 17.

Dairy Cattle.

The national dairy cattle population numbers 1,483,000 cows, comprising three major breeds:—

(1) The Black-and-White Friesland-Holland breed (F-H breed), approximating 72% and occurring mainly in the province of Friesland, North Holland and South Holland.

(2) The Red and White Meuse-Rhine-Ijssel breed (M-R-IJ breed) approximating 24%. This is somewhat of a beef breed.

(3) The Black White-Head Groningen breed, approximating 4%. This was originally a beef type but has been improved in the direction of milk production.

Herd Improvement.

Milk production has been progressively increased by selection, production recording and breeding from approved bulls. Since the establishment of the Central Milk Recording Service, 55.3% of cows are now recorded. Their average yield is 825 gal. milk with an average test of 3.65%. The average lactation period is 310 days, compared with 210 days in Queensland.

Progeny testing is highly advocated in all provinces and only pedigree bulls descending from dams and grand-dams complying with minimum production requirements are licensed. In most provinces these standards are supplemented by conformation requirements.

Of 800,000 recorded cows, 48% are recorded once a fortnight and the collection and elaboration of the yield records are carried out according to uniform directions prescribed by the Central Milk Recording Service at Arnhem.

The expansion in herd recording has been encouraged by a bonus scheme, financed by a levy of approximately 25 cents per 100 gal. milk and a bull subsidy. The cost of herd production recording is nevertheless borne mainly by the farmer, whereas in Queensland the farmer bears about one-third of the cost. However, with only 4% of cows now being recorded in this State, there is much room for expansion in this widely accepted scheme for herd improvement, which has benefited dairy production so greatly in the Netherlands.

Artificial insemination is now a general practice for accelerating cattle improvement and about one-third of

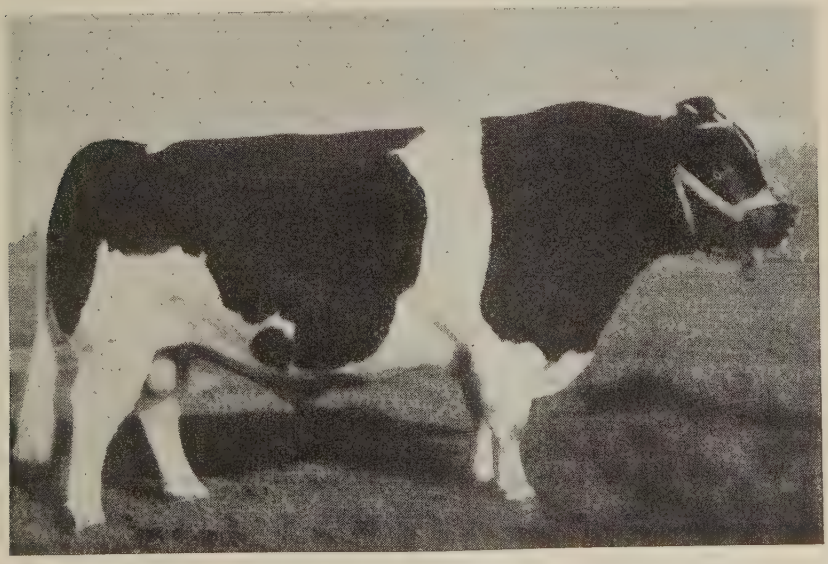


Plate 1.

A Proven Dutch-Friesian Sire in Holland.

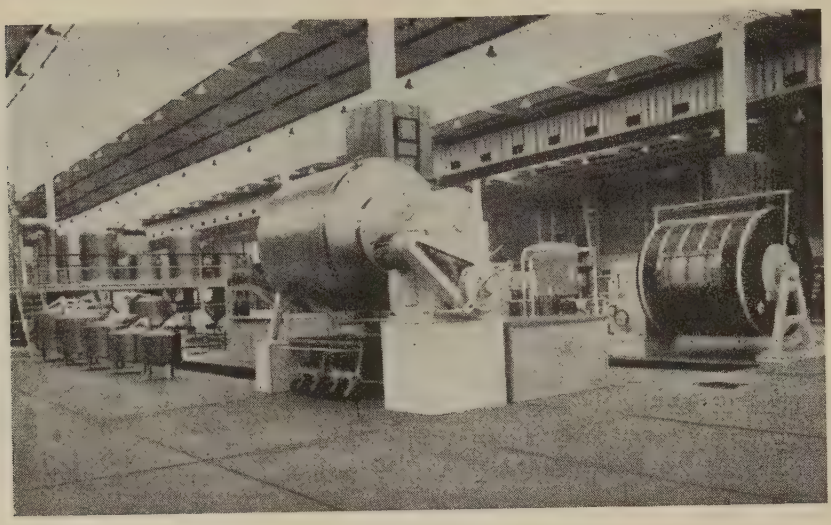


Plate 2.

Modern Dairy Equipment at a Utrecht Machinery Exhibition.

the national herd is artificially inseminated. Dairy farmers applying artificial insemination must belong to a milk recording society and bulls used must conform to minimum standards of production and conformation. Some 700 bulls are now used for artificial breeding purposes and each A.I. society serves from 2,000 to 10,000 cows. The conception rate is 87% after one or more inseminations.

Such breeding methods are favoured by the small numbers of cows in each herd and the large number of farms in closely settled areas. Thus on small farms production has been increased by the inclusion of a high-producing cow in the herd in place of the bull. Also, with the development of a more uniform breed of cow, artificial insemination has encouraged better feeding with resulting increased milk production.

Although the practice of artificial breeding is considered economical with herds up to 25 cows, larger farms and longer distances of transport in Queensland present difficulties. In any case, artificial insemination would be less beneficial until better feeding of dairy cattle can be practised.

A five-year plan for the eradication of bovine tuberculosis has been introduced by the Government in co-operation with farmers' organisations and good progress has been made in freeing some districts.

Another step in the improvement programme has been the establishment of some 300 grass-drying plants throughout the Netherlands, to supply cattle with additional feed of high nutritive value. Although costly, the technique does assure a sound method of preserving grass (in bulk, ground or pelletted) at a protein content varying from 16% to 20% and at a period when the pasture is most nutritious. Where heavy concentrate feeding is practised, the process is claimed to be less costly than purchasing imported concentrates. The method may have limited application in Queensland because of costs.

In summer, dairy cattle feed mainly on grass, and milk yields are highest during this period. Over the winter months, the cattle pass into the cowhouse and are fed mainly on hay, grass silage, artificially dried grass, tuberous plants and roots. From 650 to 880 lb. of concentrates per milking cow are also fed per annum.

Based mainly on a manufacturing dairying economy, the feeding of concentrates has not proved economical in Australia. However, as most cows are expected to produce at least 3 gal. milk on good home-grown roughage such as hay and silage, before feeding concentrates, a similar approach in this country might prove worthwhile.

The care of cattle on most properties is facilitated by the living quarters adjoining the barn. This development, which is favoured under the very severe winter conditions normally experienced, could not be practised under tropical or subtropical conditions.

In summer, milking in the fields is common with the aid of mobile milking units. All milk is delivered twice daily to the factories. Small herds and short distances to factories facilitate such practices. It is doubted if mobile milking units would have application in Queensland. However, their value in building up soil fertility and their convenience on small farms in the Netherlands are appreciated.

Dairy Production.

About 80,000 dairy farmers supply over 400 co-operative dairy factories in the Netherlands. With a total milk production of 1,118 million gallons, the Netherlands is an important world supplier of evaporated, condensed and dried wholemilk, butter and cheese:—

Butter	73,000 tons.
Cheese	145,000 tons.
Condensed milk	227,000 tons.
Powdered milk	39,000 tons.

Holland produces more condensed milk than any other country, occupies second place for cheese and is the third highest producer of butter. Much attention is also being given to the utilisation of whey. Some whey is fed to livestock but much is converted into lactose and whey powder.

Dairy production is approximately five times greater than in Queensland, from a similar number of cows, and is thus an indication of the efficiency

Plate 3.

Edam Cheese Prepared for Market.

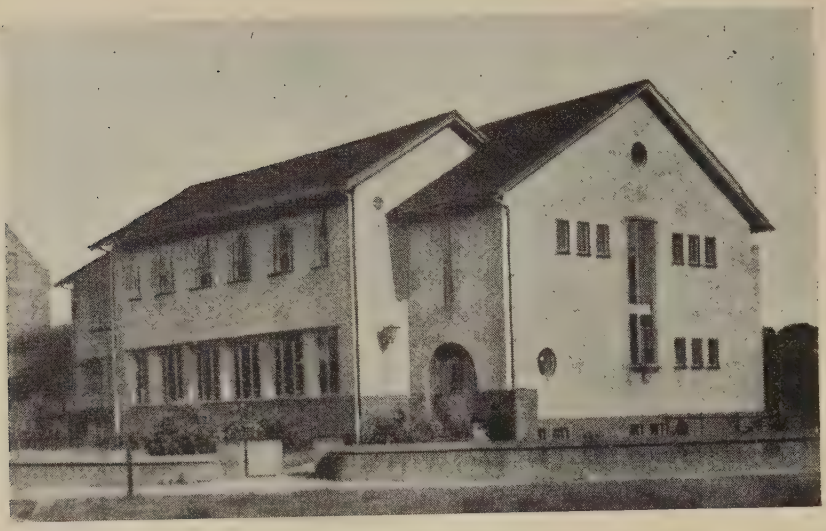


Plate 4.

The Dairy Research School at the Agricultural University, Wageningen.

of dairying practices generally. Economy in production and processing is also indicated by the fact that minimum prices are fixed for export, whilst the average return to the producer is little more than 2s. 6d. (Australian) per gal. For the market milk trade, milk is standardised to an average fat content of 2.5%.

Much attention is given to the improved packaging and labelling of dairy products, particularly fancy cheese such as Gouda, Edam, Gruyere and Roquefort. It is also highly significant that only the highest quality dairy produce is approved for export. Good packaging and attention to quality serve as valuable aids in the

Plate 5.

A Typical Dairy Pasture in Holland Consisting Mainly of Ryegrass and Clovers.

Plate 6.
Gouda Cheese on a Co-operative Dairy Association's Floor.

disposal of Dutch dairy produce and warrant greater consideration in this country.

Aids for Improvement in Quality.

Strict grading of all dairy produce is enforced and all milk is paid for on a quality basis. Payment on butterfat is the rule, together with a price differential for bacteriological quality based on the methylene blue test. Premium prices operate for milk, varying from approximately 1d. to 2d. gal. based on a 4½ hr. and 5½ hr. methylene

Plate 7.
High Producing Dutch Friesian Cattle.

blue test over the summer and winter months respectively. These offer a valuable economic incentive for improvement in overall quality of dairy produce.

To further assist improvement of quality, intensive advisory services are provided by both the industry and the State. These include regulatory measures, zoning, payment on grade, education of factory operatives, laboratory quality control services and research, together with a sound marketing organisation.

The technical advisory services are well developed and include advice from 9 butter control stations or laboratories, 5 cheese research laboratories and 1 condensed milk laboratory. Further research activities are provided for by the Dairy Research Institute at Wageningen, the Government Dairy Station at Leiden, and the industry's Research Laboratory at Leeuwarden. This general appreciation of the value of technical advice throughout the industry accounts for the progress and rapid recovery of the Dutch dairy industry in the post-war years—an example which should be followed by more dairying organisations throughout Australia.

In addition, dairy schools for factory operatives, correspondence courses and short courses of instruction are held, as is the case in a number of Australian States. Intensification of such services here, however, would prove worthwhile.

It is thus concluded that best use has been made by the Dutch dairy industry of all the technical facilities provided by both the Government and the industry. Fodder conservation, breeding and management have been soundly applied, production methods are good, and advisory and extension activities are excellent.

Coupled with research, a very sound industry has been developed which will continue to set an excellent pattern for other countries to follow.

VOL. III. OF THE "QUEENSLAND AGRICULTURAL AND PASTORAL HANDBOOK."

"INSECT PESTS AND DISEASES OF PLANTS."

This book holds a wealth of information on pests and diseases affecting cultivated plants in Queensland. It contains 560 pages and over 300 illustrations.

Obtain your copy now from the Department of Agriculture and Stock, Brisbane.

Special Price to Queensland Producers—10s.—Post Free (Others £1, Post Free).

Dairy Farm Refrigeration in the Roma District.

By G. R. SIGLEY, Senior Dairy Adviser, Division of Dairying.

To-day competition on overseas markets makes it imperative that Australian dairy farmers produce a high quality milk from both the compositional and the bacteriological points of view.

The main factor to be considered in uplifting the quality of our butter and cheese is a substantial improvement in the quality of the milk and cream from which it is manufactured.

Quality production of the raw product is dependent upon three main essentials, which can be classified as follows:—

(1) The production of wholesome milk drawn from the udders of a healthy, well fed and properly cared for herd.

(2) Cleanliness strictly applied throughout the entire milking operation and inclusive of utensil cleansing.

(3) Efficient cooling and storage of the product produced on the farm. High atmospheric temperatures experienced during the summer months favour the rapid multiplication of bacteria and if a good article is to be presented before the consumer it becomes necessary that effective control measures be adopted.

In dealing with cooling it should be appreciated that milk when drawn from the cow is practically free from micro-organisms, but despite normal precautions a certain amount of bacterial contamination takes place. Also, freshly drawn milk contains substances which retard bacterial growth for a certain time. This protection is lengthened by prompt cooling but it loses its effect where early cooling is not applied.

Therefore, it is essential that cream be cooled as soon as possible and to as low a degree as possible.

The answer to the efficient farm cooling of cream was first established in the Roma district.

Roma is situated 318 miles west of Brisbane and is in a dry, low-rainfall belt. The Co-operative Dairy Association, of which Mr. R. S. Beresford is the Manager, has a total of 104 suppliers at the present time. The bulk of the cream is drawn from within a radius of 30 miles of the townships of Wallumbilla and Injune and atmospheric temperatures reach as high as 109°F. during the summer months.

Mr. Beresford claims that he was instrumental in pioneering dairy farm refrigeration in Queensland and in doing so he is appreciative of the splendid service that has been and is being given by the Queensland Butter Marketing Board to this all-important phase of quality cream production.

The first farm refrigerator was installed in the Roma district in the year 1936, with the peak of the installations taking effect in the period 1939-1943. At one time there were 86 units operating in the vicinity, but with the diversion of a number of the farms from dairying to cattle and sheep raising there has been a decrease to just over 50 refrigeration plants operating in the area. It is expected that an additional 12 units will be installed during 1956.

During the years 1946-1947 the Queensland Butter Marketing Board set up a refrigerator manufacturing department designed to place units the reach of every farmer within the State.

Mr. Beresford said he was first tempted to introduce refrigeration to the farms because he considered that at that time all existing methods of cooling were of limited efficiency and bacterial multiplication could not be

suppressed to a degree where a good quality product was assured.

The type of unit installed by Mr. Beresford is described as follows:—

All the cabinets were built locally and were made to suit the requirements of the individual farmer.

They were constructed of T & G timber (chiefly cypress pine) and insulated with 3 inches of Canite, double dipped in bitumen and lined with galvanised iron.

The brine tank is of approximately 35 gallons capacity and the cream storage compartment ranges in accommodation from 5 to 18 six-gallon cans. The space occupied by 4 six-gallon cans is equivalent to that utilised by 3 eight-gallon cans.

Some cabinets are built to ground level and others elevated, whilst the inlets vary in that some are fitted with side-opening doors and others with top lifting lids.

The majority of the plants are driven with a 3 h.p. diesel engine, whilst the compressors are of ¾ or 1 h.p. and the refrigerant used is alcohol (methylated spirits).

For pre-cooling, a small tubular-type surface cooler is fitted to the top of the can and the cream is shock cooled from approximately 90°F. when it reaches the top of the cooler to at least 45°F. prior to being placed in the cabinet.

The cost of the complete unit when installed (1939-1943) ranged from £140 to £180, depending upon the size purchased.

In the past, practically all these units have been installed and serviced by Mr. Beresford.

The average running time per day during extremely hot weather and when production is at its peak is approximately 6 hours.

During a recent survey conducted by officers of the Department of Agriculture and Stock at the Roma Butter Factory, a check on cream temperatures and acidities was carried out.

Cream from the Wallumbilla area was checked out of the refrigerator at 52°F. at 9.30 a.m. Following road and rail transport it was delivered to the factory receiving platform at 4.30 p.m., when the temperature was again taken. All cans graded choice, the average acidity being .11% and the temperature 70°F. The cream in question was produced during the period from the Wednesday evening to the Friday morning and the atmospheric temperature was well above the average for summer weather.

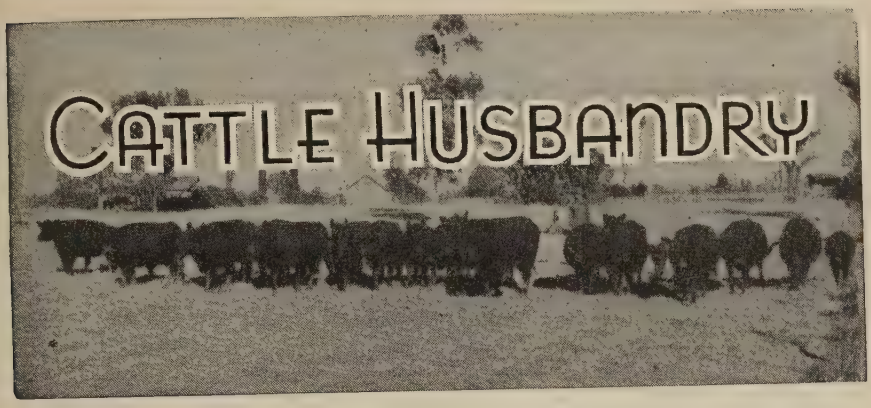
In comparison, the average acidity of uncooled bulk cream produced over the same period was .46%, whilst the temperature reading was 85°F.

Another supplier from the Wallumbilla area forwarded 10 cans of refrigerated cream produced over a four-day period. This cream was 10 hours in transport to the factory and arrived in splendid condition. The average temperature was 68°F. and the cream was of bright choice character indicative of good production methods.

Refrigerated creams from the Injune area were also revealed as being of good quality. In one instance the cream was transported 30 miles by road to the railway siding of Injune, from where it normally departs at 11.15 a.m., arriving at Roma at 4.30 p.m. On the day of the survey this particular cream was delivered to the factory platform at 6.15 p.m., making it close to 10 hours since it was taken from the refrigerator. It is only when the time involved in long haulage is given careful study that a full appreciation of the value of refrigeration can be obtained.

In reviewing farm refrigeration, Mr. Beresford states that it has given convenience to the producer and afforded added protection to the cream.

Mr. Beresford is to be commended for his foresight, initiative and industry in developing this all-important phase of quality production.



The Beef Cattle Industry of Central Coastal Queensland.

By J. ARBUCKLE, Adviser, Cattle Husbandry Branch.

This article deals with the cattle country within a radius of 100 miles of Rockhampton, which embraces the lower reaches of the Fitzroy and Dawson River systems as well as the Callide, Boyne and Calliope Valleys. It includes an area of comparatively intensive beef breeding and fattening country, together with some dairying and agricultural areas.

Reference to the map (Plate 1) indicates that the region consists of a narrow strip of coastal plain separated from a larger sub-coastal region by a low mountain range 10 to 30 miles from the coast. Although this range is comparatively low, in most places it is rough and precipitous and constitutes a formidable barrier. There are, therefore, few places where stock routes or roads travel directly from the hinterland to the coast.

CLIMATE.

Climatic conditions fluctuate considerably, with high temperatures, high humidity and most of the rainfall during the summer months, followed in the winter by warm days and cool nights with frost and little rain.

The mean temperatures and humidities are at critical levels for British breeds of cattle during the months of December to March.

Tables 1 and 2 summarise the temperature and rainfall data for a number of centres in Central Queensland.

The rainfall distribution combined with hot humid conditions tends to produce quick-growing, early-maturing pastures, providing an abundance of feed, in the summer months. These pastures generally reach their peak in

TABLE 1.

MEAN SHADE TEMPERATURES FOR SUMMER AND WINTER.

Station.	Summer (Dec., Jan., Feb.).			Winter (June, July, Aug.		
	Mean Max.	Mean Min.	Mean Temp.	Mean Max.	Mean Min.	Mean Temp.
	°F.	°F.	°F.	°F.	°F.	°F.
Gladstone	85·4	71·5	78·5	72·7	53·9	63·3
Mt. Morgan	88·1	68·5	78·3	71·8	48·8	60·3
Rockhampton	89·6	71·7	80·6	74·8	52·2	63·5
St. Lawrence	88·1	71·5	79·8	74·9	52·6	63·7
Biloela	91·1	65·8	78·4	72·1	43·1	56·7

TABLE 2.

RAINFALL.

Station.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Av.
Gladstone ..	7·27	7·29	4·96	2·50	1·83	2·57	1·84	0·91	1·23	1·91	2·84	4·83	39·98
Mt. Morgan..	5·67	5·49	3·52	2·09	1·39	2·19	1·53	0·93	1·01	1·92	2·51	3·97	32·13
Rockhampton	7·39	7·74	4·48	2·53	1·60	2·51	1·73	0·82	1·22	1·78	2·48	4·67	38·95
St. Lawrence	8·93	7·67	5·41	2·73	1·74	2·46	1·36	0·79	1·19	1·76	2·40	4·67	41·10
Biloela ..	4·48	4·75	2·67	1·91	1·72	1·93	1·25	0·59	0·87	1·78	2·87	3·65	28·97

April and decline rapidly after maturity. The response of pastures to winter rain is governed largely by soil temperatures, and there is little pasture growth even under abnormally wet winter conditions until late August or early September.

TYPES OF COUNTRY.

The soil types, vegetation and topography of the land in Central Queensland vary. In the following classification the main classes of country, together with their use and carrying capacity, are described.

Tea-tree Country.

This type of country occurs east of the coastal range. It carries a heavy cover of tea-tree (*Melaleuca leucadendra*). The grass cover is sparse and consists mainly of bunch spear grass (*Heteropogon contortus*) and white and other three-awned spear grasses (species of *Aristida*). It is often well watered by creeks which have restricted areas of paspalum (*Paspalum dilatatum*) along their course. Townsville lucerne (*Stylosanthes sundaica*) has been introduced with success on the higher country.

The soils are podsolised. They vary in texture from sands to clays and are generally very acid.

Tea-tree country has a light carrying capacity (a beast to 30 acres). It does not lend itself to easy improvement, as the timber suckers readily after ringbarking. Cattle pastured permanently in the area show symptoms of mineral deficiency.

Forest Country.

This type of country, which borders the alluvial and flood areas, constitutes the greatest area of country used for grazing beef cattle in Central Queensland. It is open eucalypt forest with ironbark, bloodwood, box, mahogany, gum, coolibah and Moreton Bay ash as the main species. All of these timbers can be killed easily by ringbarking.

The main grasses are bunch spear grass and three-awned spear grasses, blue grasses (species of *Bothriochloa* and *Dichanthium*), red Natal grass (*Rhynchelytrum repens*), and kangaroo grass (*Themeda australis*).

Owing to the undulating and ridgy nature of the country, cultivation is restricted to small areas on the creek and river flats.

Undeveloped forest country carries approximately a beast to 20-24 acres, and when rung and fenced the land will carry a beast to 10-15 acres.

Frontage Country.

Areas of alluvial or frontage country occur along most of the rivers and creeks and constitute the best of the fattening country. Apart from the fertility of the alluvial flats, the streams ensure a good natural water supply which enables full use to be made of the country.

The main river is the Fitzroy, into which drain the Dee, Don, Dawson, Mackenzie, Alligator Creek, Isaacs and many small creeks. The extent of frontage country varies from half a mile to 10 miles on each side of the watercourse.

The chief timbers are coolibah, box, mahogany, gum and ironbark, all of which can be killed easily. Often the alluvials are covered with water up to 20 ft. in depth during the height of the wet season, and when this drains off sweet pastures of nutgrasses (species of *Cyperus*) and blue grasses

grow quickly. On the higher ground black spear grass is the dominant species.

The flats can be improved at low cost, the main expenditure being for fencing and ringbarking. The country has a fairly heavy carrying capacity and is used chiefly for fattening bullocks and spayed cows. It is considered that the best alluvial flats will fatten at a beast to 6-8 acres.

Brigalow Country.

Brigalow scrub covers a variety of soil types ranging from alluvials to grey-brown clay melon-hole country. The term brigalow country denotes a good dark-brown to black self-mulching calcareous soil type which makes first-class land for agriculture when cleared.

There are a number of different types of brigalow, and these react to

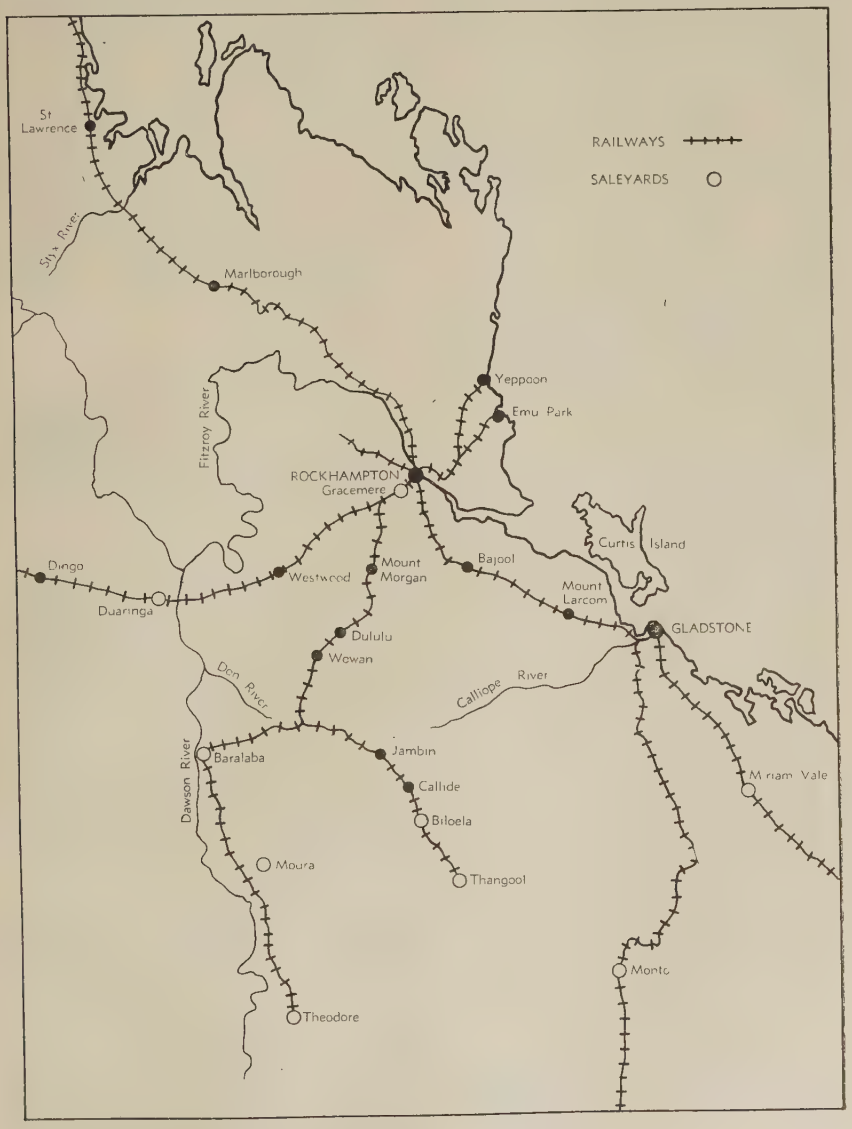


Plate 1.

Sketch Map of the Central District.

ringbarking and clearing in different ways. It is always advisable to consult local opinion before attempting any improvement programme.

Brigalow does not shoot or sucker from above the ground to the same extent as do the eucalypts. Regrowth takes place from the root system under the ground, and any procedure which is likely to bruise or break the roots after ringbarking will encourage suckering. The most common cause is burning too soon after ringbarking. The hooves of cattle after rain will sink and damage the roots, and so cause suckering. If brigalow does sucker, it generally grows so thickly that sunlight is shut out from the ground and pasture growth is suppressed almost entirely.

Brigalow is often found in association with belah, budda (sandalwood), wilga and yellow-wood in dense scrubs, and on more open flooded country is often associated with bauhinia and yellow-wood in small clumps.

The main grasses found on this type of country are brigalow and sago grasses (species of *Paspalidium*), nut grasses (species of *Cyperus*) and in the more open areas Flinders grasses (species of *Iseilema*), Mitchell grasses (species of *Astrebla*) and silky browntop (*Eulalia fulva*).

A feature of much of the brigalow country of Central Queensland is the great variety of winter herbage plants which grow in favourable years. For this reason the brigalow flood plains of the Dawson, Mackenzie and Fitzroy constitute the best winter fattening country in the area.

The carrying capacity of brigalow country is not high, but what cattle it does carry thrive at the rate of a beast to 15 acres on the best country, and up to a beast to 25-30 acres in the heavier scrub. Cattle generally winter well in brigalow country, as they are well protected from frosts and cold winds and have the advantage of good herbage in favourable years.

Marine Plain.

There are some extensive areas of marine plain north of Rockhampton bordering the shores of Broadsound, as well as limited areas of similar country on the Fitzroy between Rockhampton and the sea. The soils are essentially alluvials of a grey puggy nature, deficient in copper, treeless and covered with marine couch.

Where para grass (*Brachiaria mutica*) has been introduced it has thrived and made a noteworthy contribution to the carrying capacity and fattening potential of the country.

During the wet season, large areas of this country are covered with water, and relief country is needed. The water table is high and grasses respond well to warm weather in the spring, when the stocking rate may be as high as a beast to 3 acres on para grass.

Range Country.

The main coastal range runs parallel with the sea coast through the length of the area. This range, together with its spurs and offshoots, has a large bearing on stocking rates and cattle movements.

Range country can only be lightly stocked (a beast to 30-50 acres), and much of the area is inaccessible to stock. In most cases, it is a hindrance rather than an asset to its owner, as it is common to find such pests as lantana (*Lantana camara*), zamia or burrawang (*Macrozamia spiralis*) and poison peach (*Trema aspera*). It is also a good harbour for tree pear, dingoes, wallabies and "scrubber" cattle.

In some areas, lightly timbered accessible ranges are considered an advantage, as male cattle winter well on the lower ridges and valleys where the grass remains sweet for a long period.

Water is often a problem in this country, as generally it does not carry enough stock to warrant expensive watering facilities and therefore is

only used while local surface water is available from the first summer storms until August.

The coastal range does, however, have an important influence on rainfall on the coastal plain. Where the coast range is relatively high, rainfall on the eastern slopes may be as much as 60-70 inches, but where the coastal range is relatively low rainfall may be as low as 35 inches. The number of good creeks and small rivers running to the sea from the coast range ensures adequate surface water in the area immediately to the east of the ranges, and in the area of the larger streams, such as the Boyne and Calliope, good grazing country is available along the lower flats.

BREEDS.

The Hereford is the most popular breed in Central Queensland and is the basis of probably 90% of the commercial herds. This breed has adapted itself well to the coastal conditions, being hardy in times of drought and responding well to good feed and management. It produces young, sappy, heavy finished bullocks of the type required by the export trade.

The Poll Hereford has all the characteristics of the Hereford and is becoming more popular, particularly in the better areas where younger beef is turned off.

Herefords and Polled Herefords are subject to epithelioma (cancer) of the eye, and this is a serious source of loss in breeding cows over four years of age.

There are about six herds of Aberdeen-Angus in Central Queensland. They have proved their ability to mature early, developing to a fleshy compact beast on the better class country. They tend to be flighty when bred on large runs with infrequent handling.

One of the largest commercial herds of pure Devons in Australia is situated in this area. Breeders have found them good cattle, with the bullocks dressing approximately 630-640 lb. at 3½ years in Brisbane. The spayed cows and heifers also have a good reputation for weight and grading. Bulls are sold mainly for mating with Shorthorn cows.

Since the introduction of purebred Zebu cattle to "Waverley" and "Glenprairie" in 1933, this breed and its crosses have increased in numbers until at the present time approximately 15% of the herds on the coast have some precentage of Zebu in them.

The Zebu has been crossed with the British breeds, resulting in varying fractions of Zebu. The most popular cross is from ¼- to ½-bred Zebus. These crosses have achieved greater weights at an earlier age than the purebred British cattle under adverse conditions, but there is little uniformity of type.

Until the present time, little thought has been given to constructive breeding with organised selection for desirable characteristics, so there is a big variation within the crossbred population, and even lines of fat Zebu-cross bullocks are not available for the market.

Because of the great variation in type and conformation, together with certain disadvantages in temperament, it is doubtful if the Zebu breed has made any worthwhile improvement in the standard of commercial cattle marketed in Central Queensland. However, this may be due to badly conceived breeding policies rather than to the inherent qualities of Zebu cattle.

STUD ACTIVITIES.

There are studs of all the breeds used commercially in the region and these supply stud and herd bulls to commercial growers. These studs are sufficient in number to supply the local needs, although some stud bulls are bought outside the district, particularly at the Brisbane Exhibition, where local buyers purchase up to a dozen bulls each year.

The standard of studs in Central Queensland is high, and those who take bulls to Brisbane have shared well in the prizes.

Many of the bulls used in commercial herds are selected herd bulls that are the progeny of stud bulls from good commercial herds where a calf showing exceptional conformation is left entire for a herd bull. Generally, the percentage of males kept from a commercial herd for herd bulls does not exceed 10% of the male calf drop.

Stud breeders in this area dispose of their bulls by private treaty, through the show-ring sales, and at annual bull sales, while some reserve their bulls, with the exception of show calves, for an annual sale, on the property or at a nearby town, where they are sold by auction. This method of disposal has become more popular in recent years.

OTHER INDUSTRIES.

Central Queensland is a combined pastoral, agricultural and dairying area, with a mining centre at Mount Morgan, and an open-cut coal mine in the Callide Valley approximately 10 miles east of Biloela.

Dairying and agriculture are associated in the more closely settled areas of the Dawson, Boyne, Callide and Calliope valleys, and around Rockhampton. The main towns and settlements associated with dairying are Thangool, Biloela, Wowan, Kalapa, Boyne Valley, Calliope, Miriam Vale, Mt. Larcom, Rockhampton, Raglan and The Caves. Dairy produce factories operate at Biloela (butter), Wowan (butter), Gladstone (butter), and Rockhampton (milk, butter and ice-cream).

The main agricultural production is green fodder crops for cows, grain sorghum, cotton and peanuts, with pineapples confined to a small coastal area around Emu Park and Yeppoon.

Owing to transport problems, dairying is generally confined to areas within 30 miles of the main towns; even then it is often associated with grazing.

WATER SUPPLY.

Most of the grazing land in Central Queensland is permanently or semi-permanently watered by the main rivers and their tributaries. These rivers and creeks, while they do not flow continuously throughout the year, may have permanent holes along their course. Often these holes are filled by small springs which are really the continued flow of the water underground when the surface flow has ceased. This water supply is sufficient for the frontage areas.

Other forms of water supply include wells, bores and dams (earth tanks).

Underground water supplies can be tapped in most areas at depths ranging from 16 feet to 150 feet. Often these waters have a high concentration of mineral salts, such as chlorides, sulphates and carbonates of calcium, magnesium and sodium. Analyses show a large variation in the salt content, with readings from 20 to 400 grains per gallon. Where readings exceed 150 grains per gallon, or where there is no reliable source of underground water, the only alternative is the storage of surface water.

Dams or earth tanks vary in size from 2,000 to 7,000 cubic yards, with the most popular size being 5,000 cubic yards. Tanks are often left unfenced to allow stock free access to the water. This is a most undesirable practice, owing to water pollution, breaking away of banks, and bogging of cattle. Newer tanks have been fitted with a pipe through the main bank at the base to allow for gravitational flow to a trough through a float valve, which then makes it possible to fence off the dam.

Approximate costs (1954) for water supply on the area are as follows:—

(*a*) *Boring.*—25s. to 30s. per foot, plus casing at 10s. 7½d. per foot, with 1s. per foot contract price to put the piping down a bore.

(*b*) *Mills.*—Varying from £152 for a 12ft. mill on a 30ft. stand to £543 for a 22ft. mill on a 35ft. stand. Erection costs £3 to £3 10s. per foot radius of the wheel.

(*c*) *Tanks.* — (i.) *Iron.* — £43-£67 17s. 6d.-£97 for 5,000, 10,000, 15,000 gallon capacity, plus £4 per 1,000 gallon construction costs. (ii.) *Cement.*— The contract price for a concrete water tank of 10,000 gallon capacity is £160.

(*d*) *Troughs.*—To equip with a cement trough of 1,250 gallon capacity (that is, 50 gallons to the foot and 25ft. long), the cost is £2 per foot.

(*e*) *Tank Sinking.*—2s. 6d. to 3s. per cubic yard depending on the time required to travel from the last job and the amount of work to be done. If "turkey nest" storages are to be built in conjunction with earth tanks. cost is 1s. 9d. per cubic yard, and if to be built separately 2s. 6d. per cubic yard is the contract price.

FENCING AND YARDS.

Most fences in the Rockhampton area are either 2 barb and 1 plain or 2 plain and 1 barb, with either rosewood or split ironbark posts. The present cost of erection is £180 to £190 per mile depending on locality.

In recent years iron posts have become very popular since they are slightly cheaper and quicker to erect. In erecting iron posts a wooden post is used every chain with three and sometimes four iron posts between them. Cost per iron post (Rockhampton) is 3s. 7d., compared with 3s. 6d. to 4s. for rosewood or split ironbark.

Subdivision in the more closely settled areas around Rockhampton is fairly good, with most paddocks varying from 1,000 to 6,000 acres.

Subdivision is generally carried out in relation to water supply and yards, water being provided on at least two sides of each paddock and as many paddocks as possible leading into the yards.

The number and size of cattle yards on a property depend on the size of the property and the number and type of cattle handled.

Usually one set of yards capable of working 300 to 400 head of cattle at one time is needed for every 2,000 head of cattle on the property.

The cost of erecting yards varies considerably, depending on the locality and availability of timber. Average cost per panel 6ft. high, 10ft. long, with rails tied, is £4 10s. to £5 per panel, and "joggled" (mortised in) and tied £5 to £6 per panel.

DIPS.

Plunge dips are used almost exclusively to control cattle ticks and buffalo flies; there are a few spray dips on smaller properties.

The size of the plunge dip is governed by the number and class of cattle to be dipped at any one time. Large dips up to 4,500 gallons capacity are often found on properties where large numbers of bullocks have to be dipped at a time. Users of these large dips consider there is less likelihood of injury from cattle jumping on top of one another. Usually, most dips are in the range of 3,000 to 3,200 gallons, being 40 ft. long at the top, 32 ft. at working level, 6 ft. 6 in. deep and 3 ft. 6 in. wide. With the wider use of the more expensive tickicides, there is a current trend towards smaller dips.

The contract price for a dip of this size is £600; 5 ft. 6 in. anti-splash sides cost an extra £250. The labour cost for erecting the dip, with hole dug and materials supplied to the contractor, is £250, with an extra £100 for high sides.

PROPERTY MANAGEMENT.

Beef cattle properties in this area vary in size from small "dealing" properties capable of carrying 300 to 400 head of cattle to larger properties carrying up to 6,000 head of cattle. These larger properties are often owned by companies, while the average-sized property carrying from 1,000

to 3,000 head is usually owned and run as a family unit. The area of these properties varies from 10,000 to 70,000 acres, with very few properties larger than this figure.

The view of the Royal Commission on Pastoral Lands Settlement (1951) was that a living area for Central Queensland was one which would carry from 800 to 1,000 head, depending on location.

Properties of this size usually do not fatten bullocks, but sell steers and fatten the cull cows and heifers. Most properties of this size have their herd made up as follows:—

320 breeding cows
250 calves to weaning age
120 heifers (weaners)
80 2-year-old heifers to go into breeding herd
36 spayed heifers (culls for fattening)
64 spayed cows (cull age)
10 bulls

TOTAL 1,000 head

On 1954 values this would give an approximate income of £4,460, made up as follows:—

	£
120 2-year-old steers at approx. £18 per head	2,160
100 spayed heifers and cows at £23 per head	2,300
	£4,460

Often an owner buys weaner steers, grows them for 1-2 years, then sells to a fattener. It is generally estimated that on present market values a dealer must have a gross turnover of 30% on his capital outlay per year. If he buys weaner steers this year for £15, next season he should sell for £20. If he buys for £20, he should sell for approximately £27 as fattening age bullocks. The fattener in turn should sell for £36 to £38. This margin of profit could be greater, depending on the capabilities of the property.

Another popular dealing proposition is to buy cows and young calves, spay the cows and sell the calves as weaners. Returns from this type of venture can be 50% on capital outlay and sometimes even more, being made up as follows:—

Price of cow and calf—£20

Weaner sold in 6-9 months for £14

Fat cow sold in approximately 18 months for £22 to £26, depending on quality of purchase, country, seasons and market.

It is often considered that this form of dealing is more risky than with male cattle, but it is quite a sound proposition if the country can turn off fat cows from October to February when the market is sound.

In the management of a property in this area, the basic husbandry practices are carried out in the following manner.

Mating.

Mating generally starts with the commencement of the monsoonal season in December or early January, when the bulls are returned to the breeding herd. With the storms there is a sudden rise in the plane of nutrition, which produces a high conception rate. The main calf drop thus comes in October to December and the calving period extends to April if the bulls are not removed from the herd before the end of July. Most graziers mate according to this plan. A small percentage leave their bulls out all the year; this may cause heavy losses in drought years when cows calve out of season.

Calves born after April do not grow well, as they miss the flush of milk during the autumn season and have to be weaned too young if the cow is to be mated in the next mating season.

The calving percentage in good years in most Central Queensland herds is approximately 70% to 80%,

although under extremes of management this percentage may vary 10% either way, depending on various factors.

(*a*) *Climatic Conditions.*—With good early rains giving nutritious pasture, the brandings should be high the following year. In drought years the branding figures are down, as cows in low condition do not show oestrus and bulls do not work.

(*b*) *Subdivision.*—The smaller the paddock the higher the calving percentage. In stud mating, using one bull to 45 cows in a small paddock, the calving could be expected to be over 90%, while on big runs with 1,500 to 2,000 breeders in the one paddock the calving percentage generally drops to approximately 65 to 70.

(*c*) *Age of Mating Groups.*—It is generally considered that there is a higher calving percentage in aged or mature cows (up to 95%), while the heifer population may only produce 50% to 55% calves.

(*d*) *Management.* — This includes such matters as control of dingoes, correction of mineral deficiencies, control of ticks and buffalo flies, regulation of mating and calving periods, inoculation against blackleg, fencing of boggy areas, and culling of shy and sterile breeders. If any of these matters are disregarded, a fall in the calf drop can be expected.

(*e*) *Bulls.*—On closer settled properties bulls are used at the rate of 3%, while larger places use up to 4%. Where Zebu breeding is carried out, up to 5% is used, since a small percentage of these hybrids are sterile, slow workers and late maturers.

The useful life of a bull varies from property to property. Where there is ample subdivision and cows are mated in age groups, a bull can be used on the same property for the whole of his working life, which is generally from 2 years up to 8 years of age. On properties where the one paddock is used for mating the whole herd, the working life of a bull is reduced to 3 years if the risk of inbreeding is to be avoided.

Culling.

There are three main culling programmes in commercial herds. The first takes place before mating of heifers at 2 years, when 20% to 25% of the heifer crop is culled for type and spayed. The remainder of the heifers are mated and often culled through again when their calves are weaned. This culling generally accounts for another 5% of the heifers when they are culled for type, conformation and ability to rear a calf. These culls are spayed and fattened for market. The third culling is for age when mature cows reach 7-9 years, when they are spayed and fattened. The age and severity of culling are dictated by stock numbers in relation to the carrying capacity of the property and seasonal conditions.

Weaning.

Weaning takes place from September to December, depending on the mating period and seasonal conditions.

Unfortunately, this period is often associated with drought or semi-drought conditions. This has a detrimental effect on the development of the weaners unless some provision has been made for a good weaning paddock in which to hold the weaners until the season breaks.

On larger properties with insufficient subdivision, weaners are "tailed" and taught to yard up. They are locked in the yards every night and let out and watched every day until they settle down and forget their mothers. Then they are let run in the weaner paddock.

The better managers drench and dip the weaners to ensure they are free of parasites before they go into the weaner paddock.

In an average season calves are weaned at 9-10 months when their weight averages approximately 400 lb.

GROWTH RATES.

Normally male beef cattle in Central Queensland gain weight in late spring, summer and autumn and

lose weight in winter and early spring. This trend applies every year, but the amount of weight lost varies with the season.

Beef steers put on weight following the commencement of the spring storms and continue to gain until pastures have reached maturity in late April-May or the commencement of frosts.

AGE AND WEIGHT AT TURN-OFF.

As cattlemen can readily realise, the age and weight at turn-off of cattle varies considerably with the seasons and country. Generally few fats are slaughtered in this area younger than three years. Those that are slaughtered at that age are generally of very good quality and come off good fattening country with a high standard of husbandry. Weights expected under these conditions would vary from 550 to 630 lb.

Four-year-old bullocks would account for up to 40% of the fats killed, with an average dressed weight of 620 to 700 lb., while 5-year males could be expected to slaughter at 670 to 780 lb.

Western bullocks often exceed these weights, but at an older age (generally 6-7 years).

Coastal cattle slaughtered at older than five years generally do not show any increase in the dressed weight of the younger bullocks, as they are invariably off inferior country with a lower standard of husbandry.

DROUGHTS AND STOCK LOSSES.

Approximately every five years Central Queensland has a major drought, which generally follows the pattern of a short monsoonal season ending in January or early February with no winter or spring rains. After the quick-growing natural pastures reach maturity, they deteriorate quickly and dry out.

Stock losses vary considerably within the area and where they are heavy it is often due to a combination of factors rather than the lack of rain, the more important of these being as follows:—

(*a*) *Tick Worry.*—It has been noted that ticks are prevalent in dry years and unless particular care is taken to control this parasite losses will be heavy, particularly in lactating cows.

(*b*) *Bush Fires.*—With an abundance of dry grass in the spring, bush fires are a serious problem. A Rural Fires Board Officer is stationed in Rockhampton and each district is organised into local bush fire brigades with a farmer or grazier elected in that area as the Warden.

In 1951, fires indirectly accounted for a number of stock losses by completely destroying all roughage available for stock and making it necessary for graziers to feed the whole of their herds.

(*c*) *Bogging.*—A number of properties have areas which become very boggy when the surface water dries out as creeks cease flowing. If these places are not fenced in, they will claim a big percentage of the herd, particularly breeding cows low in condition and heavy in calf. These areas can be quickly fenced, using any trees available and steel posts.

(*d*) *Overstocking.*—On smaller properties there is often a tendency to overstock in an effort to get the maximum turn-off from an area. On larger areas the country available for grazing quickly diminishes as surface water dries out and all the cattle are forced back on to the main water supplies. If these are not numerous and strategically placed so as to ensure that cattle do not have to walk more than two miles to water, a lot of country becomes unavailable.

(*e*) *Failure to Conserve Fodder.*—Until recently, little effort was made to conserve fodder as a drought insurance, but some graziers are now giving attention to the conservation of fodder as bush hay, crop ensilage and lucerne hay.

Bush hay has been baled, using a pick-up baler on native pastures cut at their best stage of growth. The average cost is about 1s. 6d. per 70 lb. bale.

With the increase in acreage of grain sorghum in the central districts, crops that do not show promise as grain crops are being cut by graziers and baled. Ensiling such crops is still in the experimental stage.

The most popular form of conserved fodder is baled lucerne hay, and one large property has conserved up to 40,000 bales in a year.

DROUGHT FEEDING.

A number of forms of drought feeding have been practised. On smaller properties feeding stalls have sometimes been built and breeders fed a ration of grain (generally sorghum or maize), meatmeal and lucerne chaff or hay. This proves very expensive, as the demand and price for supplementary fodders rise sharply during these periods.

Experience during the 1951 drought showed that feeding breeders at the rate of 7-9 lb. lucerne hay per day, provided feeding was started before cows got too weak, proved sound on burnt-out country. This amount can be reduced to 3-4 lb. per day, provided other grazing is available.

Costs for baled lucerne hay during the 1951 drought averaged £40 per ton. This gave the cost per day per breeder on burnt country (8 lb.), 33.6d.; and on dry grass (4 lb.), 16.8d.

Another property feeding 21 lb. lucerne chaff and 42 lb. crushed maize per head per week estimated the weekly cost of feed at £1 2s. per head with lucerne at £40 per ton and maize at £37 3s. per ton. On these costs it would not be profitable to feed breeders for periods longer than 3 months except in the case of particularly good animals (for example, stud cattle).

MINERAL DEFICIENCIES.

The two main mineral deficiencies in Central Queensland are those of phosphate and copper.

Phosphate deficiency is the more important. It occurs seasonally right throughout the coastal belt with the possible exception of the most fertile brigalow and softwood scrub areas. It reaches its peak in the dry spring when pastures are poor.

Until recently, little was known of copper deficiency in the area, but it has now been established on two main soil types—the marine plain and the semi-wallum country in the coastal region from Miriam Vale to Byfield. It has been detected also on some red open-type scrub soils that have been cleared for some years and are used mainly for dairying.

TRANSPORT.

Central Queensland is supplied with a fairly good railway network, which includes the main north, south and central-western lines and branch lines from Rockhampton to Theodore, Thangool, Ridgelands, Yeppoon and Emu Park and from Gladstone to Monto through the Boyne Valley.

Most of the cattle brought to Rockhampton arrive by rail. Droving to railhead or saleyards is often done by station labour, though contract drovers also operate.

There is a network of stock routes converging on trucking yards and sale centres. The stock routes are fairly well watered and grassed except in time of drought. Arrangements are generally made to yard cattle nearly every night in private yards or paddocks along the route.

SELLING AND STOCK MOVEMENTS.

Most of the larger stock agencies have branches in Rockhampton, and conduct saleyards in the district, through which they sell cattle

at auction. These country sales are mainly confined to the period from March to June. Yardings are generally mixed, with the biggest proportion of the stock being stores.

The following are estimates of the numbers of cattle sold through the yards in an average year:—

Gracemere (Rockhampton)—25,000 (fats, stores, tinners and boners).

Dingo—2,500 fats, 3,000 stores.

Comet—800 fats and stores.

Blackwater—750 fats and stores.

Moura—5,500 stores and light fats.

Baralaba—3,000 (approximately 60% stores, 40% fats).

Theodore—3,000, mainly stores, few fats and dairy stock.

Thangool—1,500 stores, fats, tinners and boners (dairy cow).

St. Lawrence—3,000 stores.

Rio-Edungalba—1,300 (half stores, half fats).

Duaringa—1,500 stores, few fats.

These figures do not represent the total turn-off of cattle from the area, as most cattle are sold in the paddock. Here the cattle are mustered and the buyer rides through them estimating their value and offering a price.

Another method commonly used is to arrange with the local meatworks for a killing date, and have fats killed on a "weight and grade" basis whereby payment is made according to the total weight of beef at the price ruling for the particular grade of the cattle slaughtered.

Most of the fat cattle from this area are killed at Rockhampton or Gladstone. The following table gives a summary of the cattle slaughtered within Central Queensland, excluding small country butchers:—

Rockhampton Abattoirs 125,000 (75% bullocks, 15% cows, 10% calves).

Gladstone Abattoirs 55,000 (75% bullocks, 15% cows, 10% calves).

Local Rockhampton Butchers 12,300 (80% cows, 20% bullocks) and 8,286 calves.

Local Gladstone Butchers 1,800 (80% cows, 20% bullocks).

Exports of meat and by-products are as follows:—

Meat and By-Products.	Rockhampton. Tons.	Gladstone. Tons.
Meat ..	9,448	3,034
Tallow ..	3,707	1,131
Skins & Hides	1,819	No Record.

The figures do not relate only to cattle bred or fattened in the area, as a number of the cattle slaughtered are from areas as far west as the Channel country, from the Central Highlands and from the western slopes and plains. There is also an outward movement of stores and fats, and an importation of stores into the area, as the following table shows:—

Cattle slaughtered in the area	193,000
Fats sold outside the district	31,504
Average number of stores imported	24,000
Average number of stores sold out of district ..	15,200

Of the cattle slaughtered outside the area in 1953-54, the distribution was as follows:—

Cannon Hill	20,601
Murrarie	724
Beaudesert	824
Townsville	7,041
Queerah	928
Bowen	46
Northern Butchers ..	660
Southern Butchers (Bundaberg and Maryborough) ..	380
Maryborough (calves)	300

The Dairy Calf: Its Feeding and Management.

By A. HUTCHINGS and G. I. ALEXANDER, Cattle Husbandry Branch.

(*Continued from page* 310 *of the May issue.*)

METHODS OF CALF REARING.

(1) Bucket Feeding.

Bucket feeding of calves is the most widely used method of rearing calves. It is simple and requires the least amount of equipment which is easy to keep clean.

Disadvantages are—

(i.) The difficulty sometimes experienced in getting the calf to start drinking.

(ii.) Calves gulp the milk in a very short time when they should suck it, taking up to 10 minutes to obtain the feed. This gulping of fluid sometimes induces nutritional scours and digestive upsets.

(2) Nipple Feeding.

This method was first used in the early part of this century, and through Departmental experiments interest has been revived in many quarters.

Its main benefit is that it reduces the incidence of digestive upsets, as calves take about 10 minutes to suck their allowance of liquid. It has been claimed that this so closely approaches natural suckling that the sucking action stimulates all the desirable digestive secretions, which may not flow so readily in quick gulping. In the calf's stomach the milk being sucked passes along the oesophageal grove to the fourth or true stomach. In gulping or drinking quickly, some milk spills over this

Plate 1.

Strong, Healthy Calves are the Result of Good Management.

Plate 2.

Mother's Colostrum is Essential to the Newborn Calf. Colostrum is rich in vitamin A, an important protection against disease in calves.

Plate 3.

Calves Raised on a Nurse Cow. Culls from the milking herd may be used as foster mothers.

groove into the rumen or paunch, where it tends to ferment, as this organ does not function until the calf is at least two weeks old. This is the commonest predisposing cause of white scours in bucket-fed calves.

Another advantage is that calves do not have the urge to suck one another after their meal.

Several nipple buckets and systems of nipple feeding have been put on the market, particularly in other countries. With nipple feeding, calves must be bailed up separately; this is an advantage.

The principle of nipple feeding is that a valve in the teat or rubber tubing resting in the bucket restricts the flow of milk which the calf sucks through a rubber teat attached to the base of the milk bucket or to one end of rubber tubing reaching over the side of the bucket to the bottom of the milk.

A disadvantage of nipple feeding is the extra pieces of utensils—teats and rubbers—to keep clean.

There is little difference between bucket feeding and nipple feeding in promoting growth in calves.

(3) Dry Meal versus Gruel Feeding.

The dry meal technique of calf rearing commenced with the introduction of calf starters. It has been used successfully in experiments and is now increasing in favour. The advantages of dry meals are that the time-consuming operations of boiling the mixture and cleaning the utensils are avoided, and the meals, being thoroughly mixed with saliva during the process of chewing, are probably more efficiently digested.

Gruel feeding has some value in that calves will readily eat sufficient to maintain uninterrupted growth when taken off milk. Occasionally a calf will not take dry meal until extremely hungry and may be only partly fed for a week. This occurs at around the fifth and sixth week, an age when the incidence of scours is highest.

Plate 4.

Feeding Bails Give Each Calf Its Fair Share of Food and Reduce the Risk of Spread of Infectious Diseases.

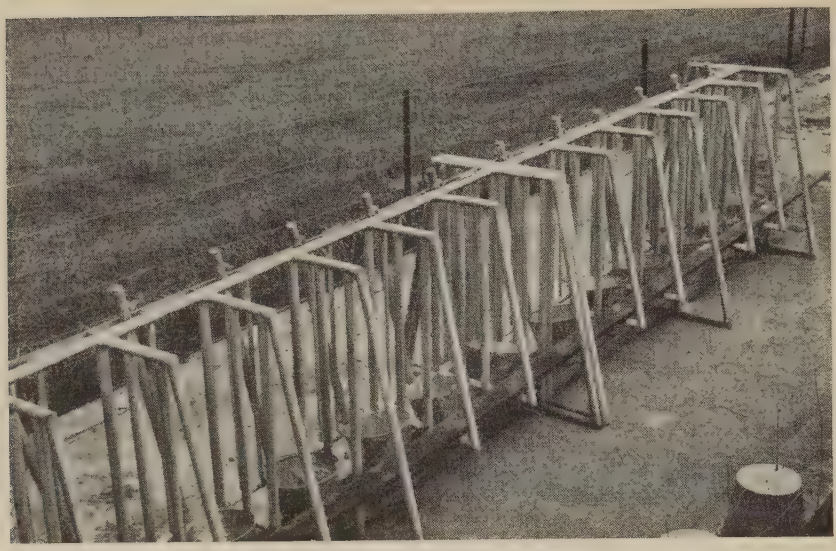


Plate 5.
Tubular Bails With Food Ready in Buckets.

There is no known difference in rate of growth of the two techniques, so that once calves will eat dry meal every advantage is gained.

CALF MANAGEMENT.

In the following paragraphs calf management will be discussed in relation to bails, paddocks, tattooing and branding, mating and other husbandry practices.

(1) Bails.

Bails are essential for correct calf rearing, as are milking bails for the herd. They ensure that each animal

Plate 6.
Wooden Sword Feeding Bails are Easily Made by the Farm Handyman.

gets its share of feed, transmission of infectious disease is reduced, and the reduction in labour is only fully appreciated when bails are used. There are a few tubular bails, some elaborate, on the market. A handy man can, however, construct simple wooden sword bails on the farm.

Portable bails are valuable when calves are being rotated in paddocks while still on the bucket. However, bails can be built in a permanent position convenient to feeding facilities and accessible for rotational grazing.

(2) Calf Paddocks and Rotational Grazing.

From two weeks old, calves should be rotated systematically in suitably sized paddocks which should be well grassed and regularly topdressed as necessary. The size of the paddock is adjusted according to the number of calves being reared, especially during the autumn and spring seasons. It may be convenient to graze off surplus feed in summer by adult animals.

Alternatively, some paddocks should be shut off and mowed while still young, preferably just before flowering. The young regrowth will be available for calves when unmown areas may be running to seed; thereby a high plane of nutrition can be prolonged later into the year.

By rotational grazing, preferably at weekly intervals, the nutrient value and palatability of pasture are increased and worm infestation is reduced. At six months of age calves can be run with the herd.

(3) Dehorning.

Dehorning is practised on numerous dairy farms. The ideal way to secure a hornless herd is to breed the horns off by using polled bulls. As there is no pure polled breed of dairy cattle, dehorning is necessary. There are three methods of dehorning calves—chemical, hot iron, and mechanical.

(*a*) *Caustic Sticks.*—Calves up to two weeks old can be dehorned with caustic potash. Caustic soda is effective but it tends to spread, injuring surrounding tissue. An area as big as a two-shilling piece should be clipped around each button and an inch ring of vaseline smeared around the area to prevent the caustic running into the calf's eyes. The caustic stick is then moistened and

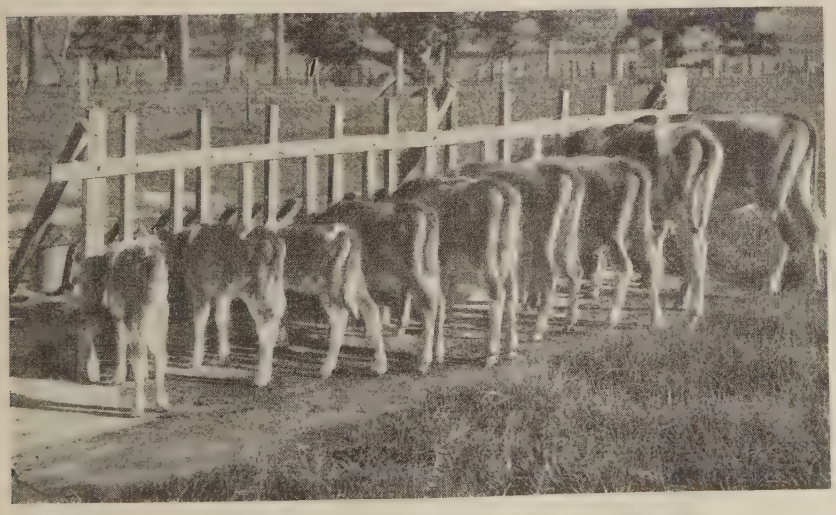


Plate 7.

Wooden Feeding Bails May be Made to Accommodate Calves of All Ages.

Plate 8.

Rotational Grazing of Calf Paddocks Pays Dividends. More nutritive grazing is assured by rotating paddocks, and worm infestation of calves is reduced.

gently rubbed over and around the button until blood starts to seep through.

Too little rubbing causes unsightly "scurs"; too much rubbing causes excessive burning and scars. The caustic should be applied only to the skin covering the bud. As caustic is equally injurious to the human skin and clothes, it should be handled with rubber gloves or paper wrapping. After treatment, the calf must be tethered where it cannot rub or get wet.

(*b*) *Antimony trichloride.*—In recent years this chemical has given satisfactory results. Any chemist can make up the solution according to the following formula:—

Antimony trichloride ..	28%
Salicylic acid	7%
Flexible collodion ..	65%

The solution is easy to apply and dries quickly. It is less painful in its action and there is no risk of it running into the calf's eyes to cause blindness. The hair around the horn is clipped, the buttons cleansed with methylated spirits, and the solution applied with a brush to cover an area as big as a sixpence. It is not necessary to tether the treated calf out of the rain. For best results, calves should be treated by this method before they are nine days old.

(*c*) *Debudding Iron.*—Use of the debudding iron is simple, efficient and only momentarily painful. Plate 9 shows the special types of debudding iron for this job. Dehorning by this method is best done at three weeks of age.

The end of the iron is hollowed to form a dome-shaped depression $\frac{5}{16}$ in. deep in the centre and measuring $\frac{1}{2}$ in. across. This depression is surrounded by an outer ring of metal $\frac{1}{8}$ in. thick and $\frac{5}{16}$ in. deep, with $\frac{1}{2}$ in. diameter (internal). A wooden handle is attached to the iron. Electric soldering irons have been adapted as efficient cauterisers. With the calf suitably controlled, the iron is heated to a cherry red and is held and twisted around the horn to sear a complete ring of tissue. This kills the tissue from which the horn grows. There is no wound for fly attack.

(*d*) *Mechanical Methods.*—Special scoop-type dehorners are used for cattle up to one year of age. When calves are three months old the horn core commences to grow out from the skull and horn removal involves opening of the frontal sinus. This opening usually closes a week or two after the operation. Hair, if long, should be clipped around the horn and the dehorner applied to remove the horn and ¼-½ in. of skin with the "bite". Strong pressure is applied to remove the horn in one movement.

(4) Tattooing, Branding and Earmarking.

While calves are easily handled, it is opportune to tattoo, brand and earmark as desired. Branding can be done with the usual hot iron. In recent years, some success has been obtained by branding with acid obtainable from firms dealing in live-stock requisites.

Tattooing and earmarking are further methods of identification. In all good breeding plans, whether in stud or grade herds, it is necessary to be able to identify each animal all its life. Tattooing and earmarking can be done as soon as convenient after birth.

GENERAL PRINCIPLES IN CALF REARING.

(1) Management in Early Life.

(i.) Avoid overfeeding at an early age. Overfeeding during the first fortnight may cause white scours and reduce resistance to infections that are often present in the surroundings.

(ii.) Feed milk at near blood heat to young calves. The temperature can be reduced for older calves, but the milk should always be fed at about the same temperature.

(iii.) A good practice is to feed milk at the rate of 10% of body weight during the first two weeks and increase to 15% during the next few weeks if desired. A rough guide is to feed 2½ quarts daily to Jersey calves and 3-4 quarts daily to A.I.S. and large breeds. Hygiene must be maintained in calf pens, paddocks and all calf utensils.

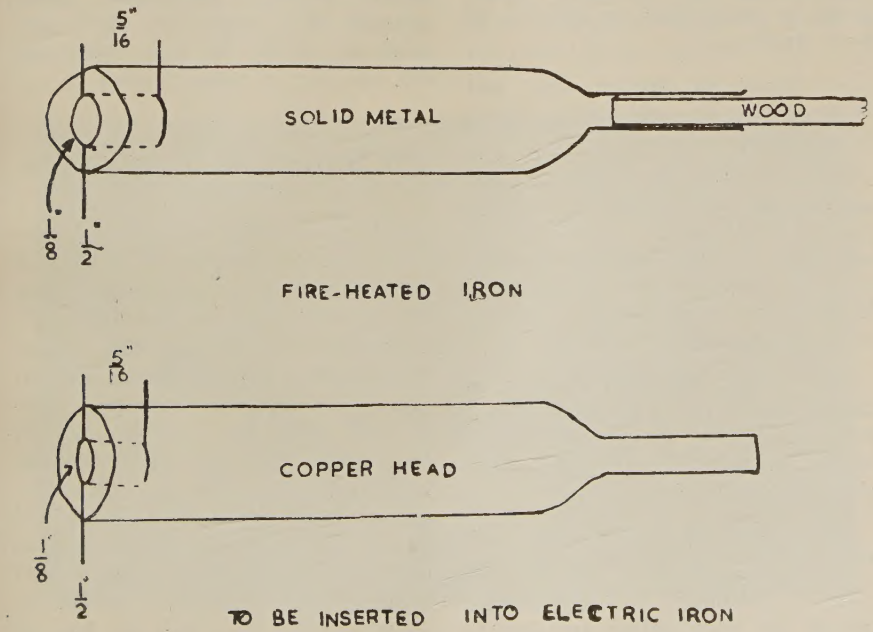


Plate 9.

Sketches of Debudding Irons.

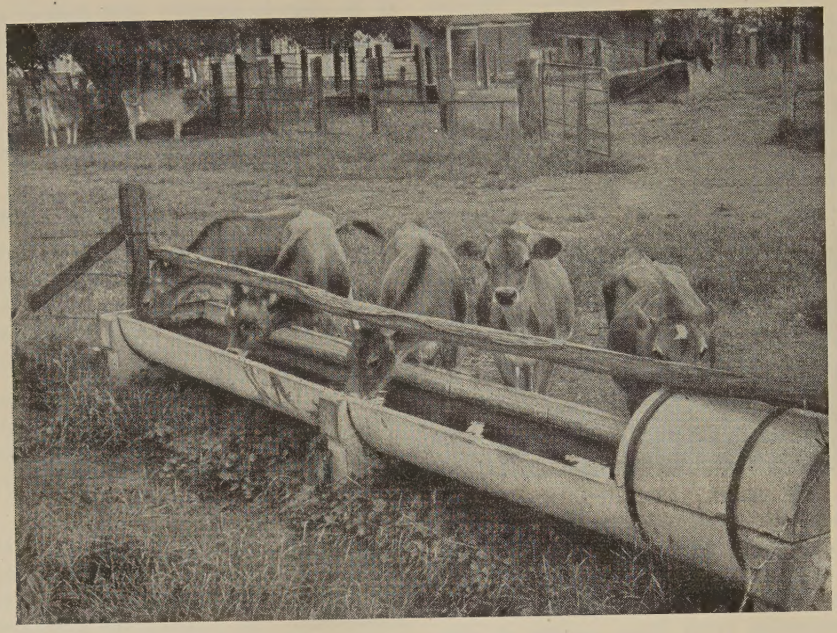


Plate 10.

Clean Water Should be Available to Calves at All Times.

(iv.) Fresh water should be available at all times, and as milk is being reduced the total volume of liquid should be maintained by addition of clean water.

(v.) Shade on summer days and shelter during the cold winter should be provided.

(vi.) Calf bails are a great advantage in calf management and feeding practices. Indeed, they are a necessity. Sword bails will suffice. Elaborate structures are not necessary. A trough for meal feeding is equally necessary for efficient calf rearing.

(vii.) Calf paddocks and systematic rotational grazing improve the nutritional standard of the pasture (except during drought times) and reduce parasitic infestations.

(viii.) Young calves should be debudded or dehorned.

(ix.) Branding is conveniently carried out when calves are easy to handle.

(x.) Calves, like all young animals, are mimics. The sight of their older mates feeding encourages their attempts at an early age. Bail construction should be such that each calf can see its mates feeding.

(2) Management in Relation to Disease.

Calf losses during early life are very severe and sometimes run as high as 20%. Indeed, several farms have been known to lose practically all their calves in some seasons. Many losses result from digestive disturbances that precede pneumonia early in life. Ticks take a heavy toll; in fact, they sometimes take the life blood of young calves. In older calves, worm infestations do untold harm. There are numerous diseases, several of which are contagious and result in high mortality. The loss by death can be seen, but the loss of production in slower growth, delayed

maturity, lack of full development and increased susceptibility to ailments is difficult to gauge.

(3) Post-Weaning Management.

After caring for the calves conscientiously from birth to five or six months, many dairymen assume that heifers can, at that stage, take care of themselves. While the first six months is the most critical period in a heifer's life, her management is comparatively easy from that time on.

Experience and Departmental trials have plainly shown that post-weaning management has been so neglected that large numbers of calves are half-starved through the winter. The Queensland temperature is very pleasant to live in except for a short hot spell in summer and a short cool spell in winter. Yet the rainfall is so uncertain as to cause poor natural growth of feed in the paddocks. Feed is often too little or frequently too rank for young stock to thrive on. Such poor pasture allows them merely to exist.

Regular calf weighings on typical dairy farms showed that 8-month-old heifers well-grown in May gradually lost weight on pasture alone through the winter and did not regain their May weight until the following September.

This lack of good feed is a great loss, for such heifers do not develop as fully as they would have done with better management.

Maturity is delayed by as much as one year. This means that the milking cow is smaller when she calves and a year of her productive life is lost.

Heifers should receive a supplement of good lucerne or pasture hay, and a pound or two of meal daily while grazing on good pasture, until one year old.

From one year, good grazing alone is sufficient. As the pasture quality declines in autumn, a few pounds per day of a good hay supplement should be made available. It is convenient to put this out twice weekly in a rack situated in a suitable part of the paddock.

Silage is an excellent roughage to feed in conjunction with, or as an alternative to, hay. Hay counteracts the laxative effects of very succulent grass. Silage counteracts the constipating effects of dry winter feed. Three pounds of silage is equal to one pound of hay in food vaule.

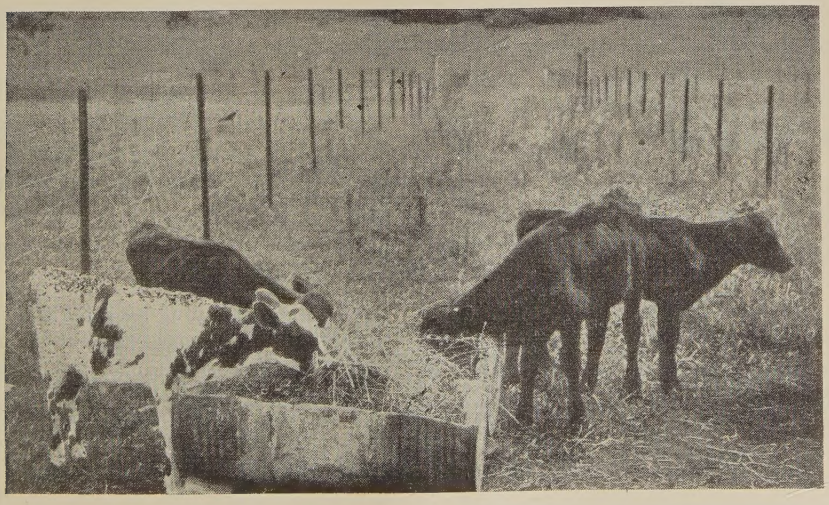


Plate 11.

Supplementary Feeding is Necessary When Other Feed is Inadequate.

The health, growth and general condition of the heifers are the guide to their requirements. There are rare occasions when over-feeding of heifers may adversely affect production in that fatty deposits, particularly around and in the udder, preclude full development of milk-secreting tissue.

At 6-10 months of age, calves should be inoculated with Strain 19 against brucellosis. This eliminates the commonest of the several causes of infertility and losses in dairy production.

The correct age at which to mate is determined by the growth and development of the heifer. The age (and the corresponding weight of well-grown heifers) of mating for the greatest expectation of lifetime production is as follows:—

Breed.	Age to Mate (months).	Weight (lb.).
A.I.S. and Ayrshire	18	700–750
Jersey	15	520–570
Guernsey	16	600–650

Heifers which are well grown for their age can be mated earlier than those less developed. The length of their productive life will be correspondingly greater.

(4) Feeding and Management before Calving.

Heifers should be well fed—steamed up—for two to three months before calving. During early lactation the high-producing heifer cannot get enough food to meet the requirements of production and body growth—for she still has to put on 200-300 lb. liveweight. Before calving, therefore, the heifer must eat enough good food to store nutrient reserves in her body to supply this sudden demand.

First-quality pasture is sufficient to meet her needs, but this is rarely available; she therefore needs supplementary feeding.

The type of supplementary feed given depends upon its availability and cost (cost per food unit). Home-grown feeds are generally much cheaper than purchased ones. Home-grown roughages are very much cheaper than purchased ones. There is the exception when there is a flush of good lucerne hay on the market with consequent drop in price. The expense of cartage of this excellent, nevertheless bulky feed, to the farm must also be considered.

Getting the heifers in good condition to calve during dry times may require up to 15 lb. lucerne hay and 2-4 lb. of grain or meal daily. If the pasture is very dry, 5 lb. of hay and 30 lb. (2 kerosenetinsful) of silage would be better.

In conclusion, it is repeated that the care of the calf starts before it is born. The unborn calf puts on three-quarters of its birth weight during the last three months of pregnancy.